CAT402-03A

Discrete Semiconductors &
Microwave Components

Summer 2003

SKYWORKS

Discrete Semiconductors & Microwave Components

Discrete Semiconductors

Varactor Diodes, PIN Diodes, Schottky Diodes, Limiter Diodes, Chip Capacitors

Microwave Components

Power Divider/Combiners, Directional Couplers, Hybrids, Detectors, Attenuators, Phase Shifters

SKYWORKS™
BREAKTHROUGH SIMPLICITY

Summer 2003

Skyworks – Premier Supplier of Wireless Semiconductor Solutions

Skyworks Solutions, Inc. is the world's largest company focused exclusively on wireless semiconductor solutions. This leadership position encompasses not only the final product, but also the technology, processing, and packaging that makes it all possible.

From the radio to the baseband, we have developed the industry's broadest product portfolio including leadership in switches and power amplifier modules. Additionally, we offer the world's most highly integrated direct conversion transceiver and have launched the industry's most comprehensive cellular system for next generation handsets.

With annual revenues of well over half a billion dollars, we deliver millions of units per year — as individual components, modules, or fully integrated systems. Our extensive offering and unparalleled systems expertise makes Skyworks the ideal partner for both top-tier wireless systems manufacturers and new market entrants who demand simplified architectures and faster development cycles.

We possess a highly skilled and motivated team of 4,000 employees worldwide. With roughly 750 engineers and hundreds of dedicated sales, marketing and technical support personnel throughout North America, Europe, and Asia, we are well positioned to respond to the growing needs of our customers.

Skyworks combines the experience of yesterday with the innovation of tomorrow. The solutions outlined in this brochure are a result of this unique blend of knowledge and technology, and are just a sampling of our broad product and technology portfolio. Feel free to contact us to discuss your design requirements to see how our solutions can best meet your needs.

New products are continually being introduced at Skyworks. Visit our web site for the latest information at www.skyworksinc.com. For additional information, contact your local sales office or email us at sales@skyworksinc.com.

Discrete Semiconductors and Microwave Components Table of Contents

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Varactor Diodes

Application/Selection Guide

Market	Function	Suggested Part Number
Telemetry	VCO	SMV1405-079, SMV1413-001
TV Distribution	VCO	SMV1139-079, SMV1265-011
Cellular Handsets	VCO	SMV1142-011, SMV1234-079, SMV1494-079, SMV1705-079, SMV1763-079
Base Station/Communication Systems	Phase Shifter	SMV1245-011, SMV1281-011
Broadband	VCO	SMV1705-079, SMV1763-079, SMV1770-079
WLAN	VCO	SMV1763-079

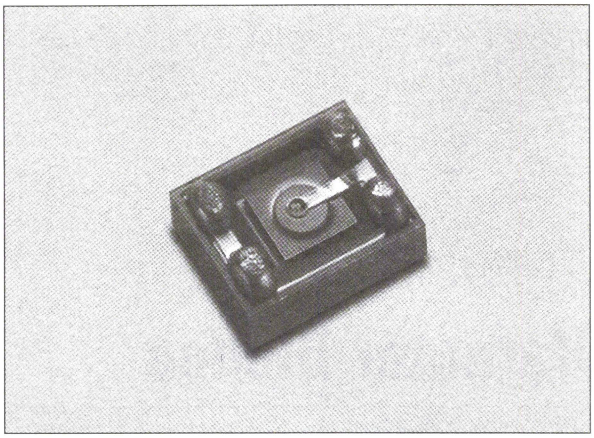
Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV1705-050

Features

- Low Series Resistance (0.27 Ω Typ.)
- Low Inductance (0.25 nH Typ.)
- High Capacitance Ratio
- Package Height is Half of the SC-79 Package
- Designed for High Volume, Low Cost Battery Applications
- Available in Tape and Reel Packaging



Description

The SMV1705-050 is a silicon hyperabrupt junction varactor diode specifically designed for battery operation.The extremely small package size and specified high capacitance ratio and low R_S of this varactor make it appropriate for low noise VCOs used at frequencies in wireless systems to beyond 2.5 GHz. Applications include low noise and wideband UHF and VHF VCO for GSM, PCS, CDMA and analog phones.

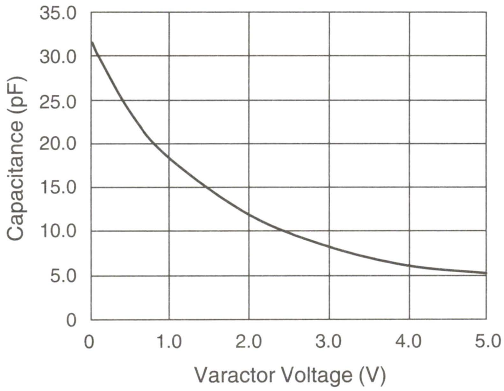
Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

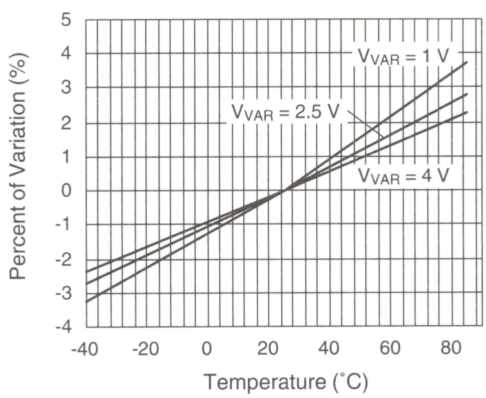
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 8 V		< 0.01	20.0	nA
Capacitance (C_T)	V_R = 1 V, F = 1 MHz	17.3	18.30	19.3	pF
Capacitance (C_T)	V_R = 4 V, F = 1 MHz	5.3	6.10	6.6	pF
Capacitance Ratio (C_{TR})	C_T (1 V)/C_T (4 V)	2.8	3.00		
Series Resistance (R_S)	V_R = 1 V, F = 470 MHz		0.27		Ω
Breakdown Voltage (V_{BR})	I_R = 10 µA	12.0			V

Typical Performance Data



Capacitance vs. Voltage

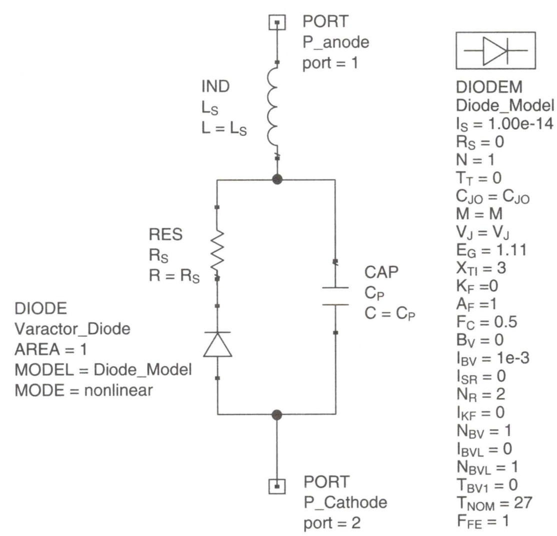


Relative Capacitance Change vs. Temperature

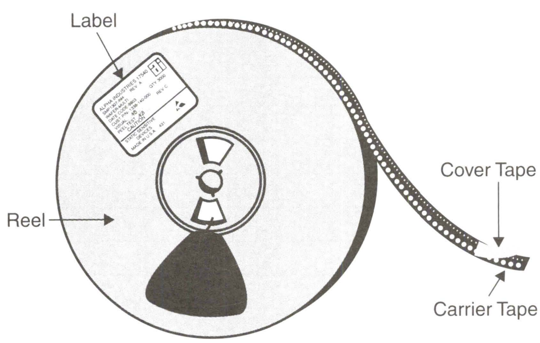
Capacitance vs. Voltage

V_R (V)	C_T (pF)
0.0	31.5
0.5	23.5
1.0	18.3
1.5	14.3
2.0	11.9
2.5	9.7
3.0	8.3
3.5	7.1
4.0	6.1
4.5	5.5
5.0	5.2

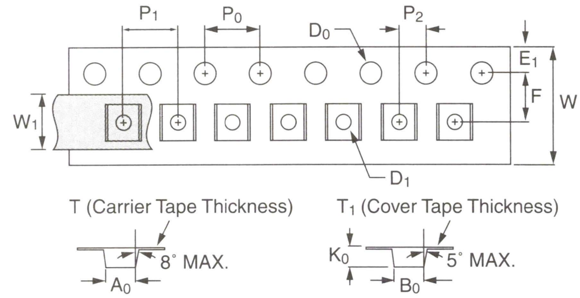
SPICE Model



Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1705-050	31	3	2	0.5	0.27	0.25



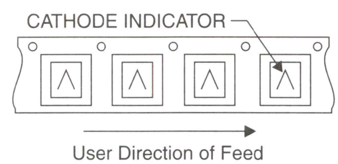
Paper Tape Dimensions



Description	Sym.	Chip Scale
Cavity		
Length	A_0	0.65±0.05
Width	B_0	0.76±0.05
Depth	K_0	0.53±0.05
Pitch	P_1	2.00±0.10
Bottom Hole Diameter	D_1	N/A
Perforation		
Diameter	D_0	1.50±0.10
Pitch	P_0	4.00±0.10
Position	E_1	1.75±0.10
Carrier Tape		
Width	W	8.00±0.20
Thickness	T	0.43±0.05
Cover Tape		
Width	W_1	5.40±0.10
Tape Thickness	T_1	0.062±0.01
Distance		
Cavity to Perforation (Width Direction)	F	3.50±0.05
Cavity to Perforation (Length Direction)	P_2	1.00±0.025

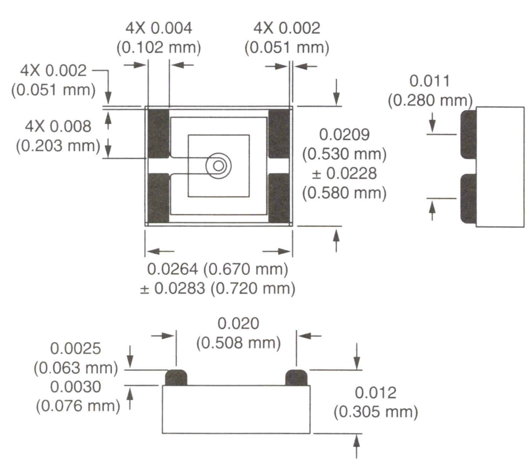
Note: All dimensions are in mm.

Chip Scale (-050)



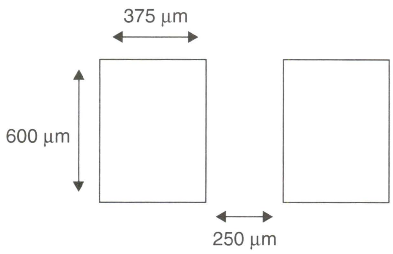
Standard Reel Size	7"
Standard Reel Quantity	12,000

-050



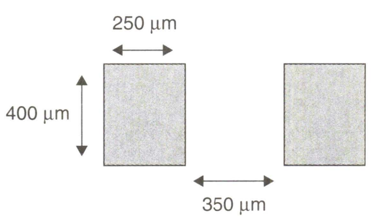
Land Pattern

The recommended surface mount pad pattern ensures quality solder joint formation and high-yielding assembly, while using minimum board space. The dimensions apply to both Solder Mask Defined (SMD) as well as Non-Solder Mask Defined (NSMD) pads. However, NSMD pads, in which the solder mask is pulled back from the metal pad, are preferred. This type of pad definition generally produces improved solder joint reliability as well as an increased gap under the component. The increased gap is desirable for enhanced cleaning of flux residue and component underfill for applications in which the component will be encapsulated.

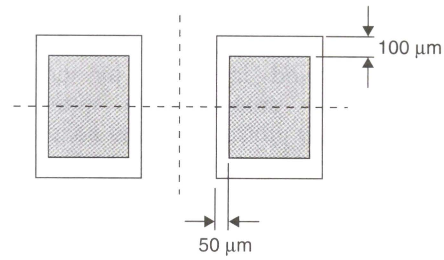


Solder Printing

The recommended land pattern, when used in conjunction with the following solder deposit recommendation, provides quality solder joint formation and high yielding assembly. Solder should be deposited with a stencil of foil thickness from 100–125 µm, and preferably have apertures that are laser-etched and electro-polished for optimal paste release. The chip scale package is compatible with most lead-based and lead-free solder pastes, though a type 3 or type 4 paste is preferred for the fine aperture printing.

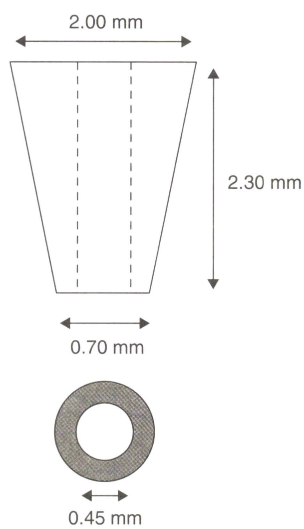


The solder deposit should be centered on the land pattern as shown.



Component Placement

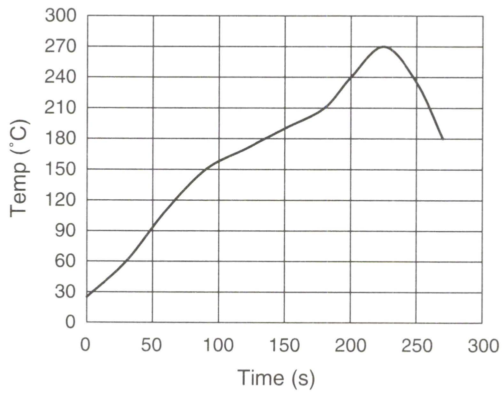
The CSP is can easily be picked and placed on most placement systems. Care should be taken to select a pick nozzle that matches the component footprint. Vision alignment after pick can be done to the package edges or the package leads, depending on the ability of the individual placement machine. The component should be placed as centered as possible to the pad and print patterns to assure even wetting and an absence of tilt or skew.



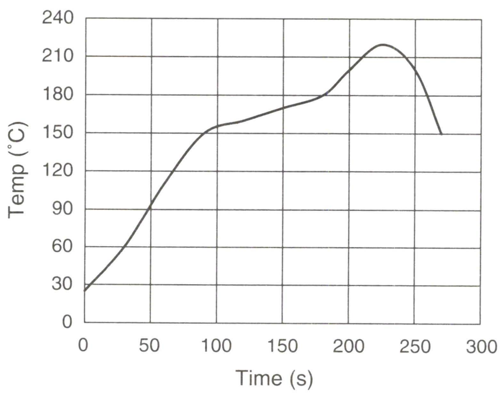
Solder Reflow

Solder reflow is best suited to convection or IR reflow systems, though convection reflow will always give more rapid and uniform thermal transfer. The CSP can be successfully reflowed in either air or nitrogen atmospheres. The solder paste manufacturer's recommended reflow profile should be adhered to and care should be taken to ensure that the profile is adjusted for variability in thermal mass amongst components. Attached are generic profiles for eutectic tin-lead solder and a typical lead-free solder.

These should only be used as a guideline, with the paste manufacturers recommended profile taking precedence. A standard solvent flux clean can be safely employed to remove flux residue from the device edges.



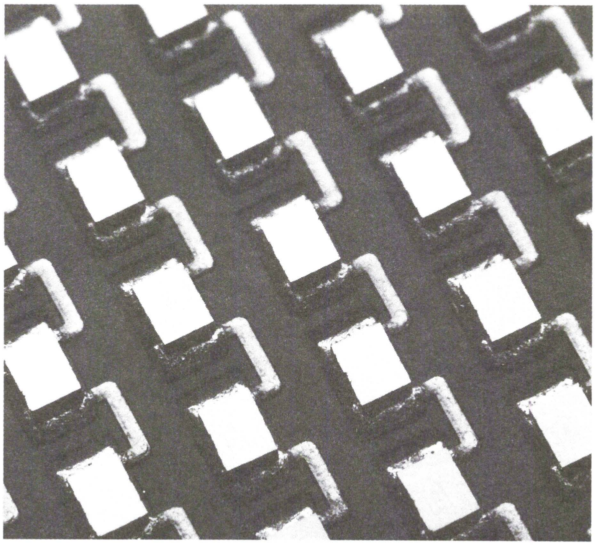
Lead Free Profile



Eutectic Tin-Lead Profile

Finished Product

Once reflowed, the component should be fairly centered on the land pattern. Solder should wet evenly to CSP leads and the component should not display excessive tilt or skew. A solvent flux clean can be safely employed if desired.



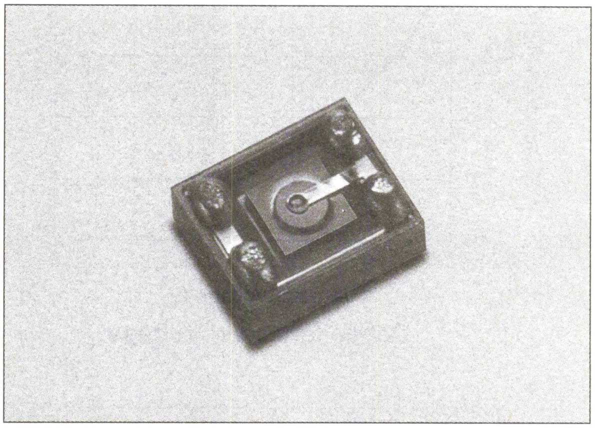
Chip Scale Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV1763-050

Features

- Miniature Chip Scale Package
- Low Series Resistance
- High Capacitance Ratio at Low Reverse Voltage
- Low Inductance (0.25 nH Typ.)
- Designed for High Volume, Low Cost Battery Applications
- Available in Tape and Reel Packaging



Description

The SMV1763-050 is a silicon hyperabrupt junction varactor diode specifically designed for 3 V platforms. The extremely small package size and specified high capacitance ratio and low R_S of this varactor make it attractive for low phase noise VCOs in wireless systems beyond 2.5 GHz. Applications include low noise and wideband UHF and VHF VCO for GSM, PCS, CDMA and analog phones.

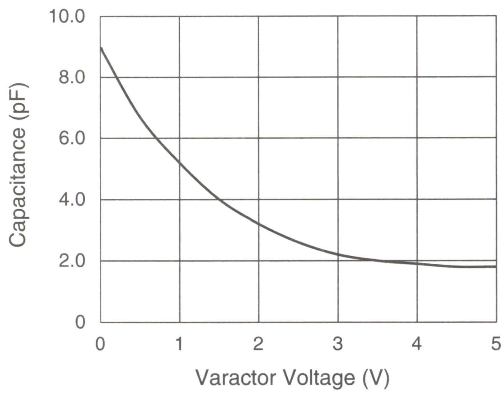
Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

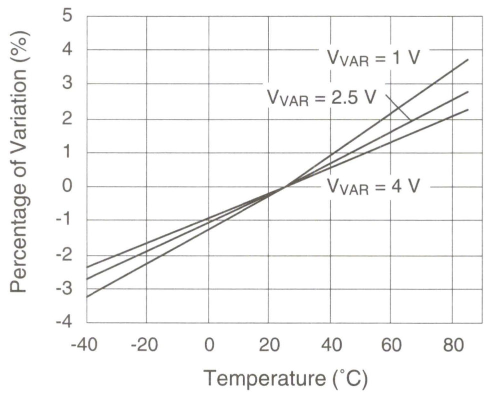
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 8 V			20.0	nA
Capacitance (C_T)	C_T @ 0.5 V, V_R = 0.5 V, F = 1 MHz	6.2	6.7	7.2	pF
Capacitance (C_T)	C_T @ 2.5 V, V_R = 2.5 V, F = 1 MHz	2.3	2.6	2.9	pF
Capacitance Ratio (C_{TR})	C_T (0.5 V)/C_T (2.5 V)	2.3	2.5		
Series Resistance (R_S)	V_R = 1 V, F = 900 MHz		0.5	0.7	Ω
Breakdown Voltage (V_{BR})	I_R = 10 µA	10.0			V

Typical Performance Data



Capacitance vs. Voltage

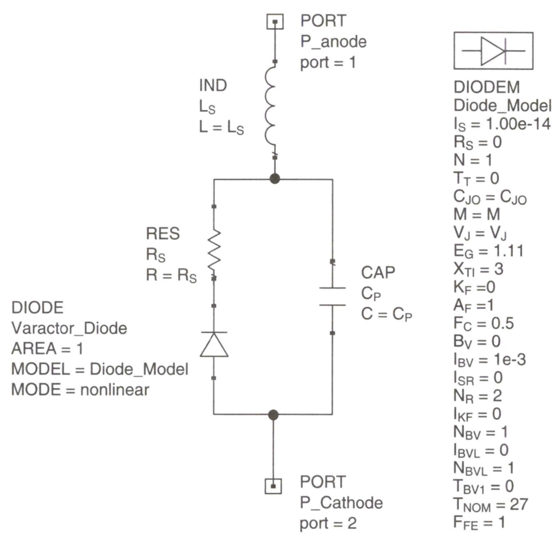


Relative Capacitance Change vs. Temperature

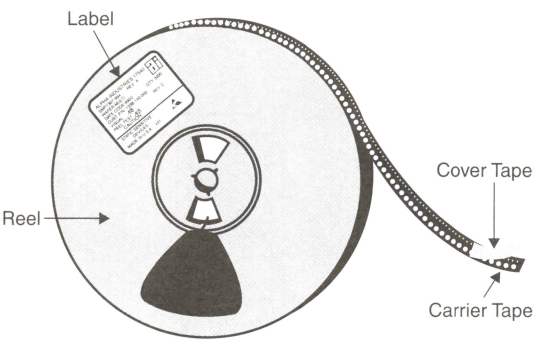
Capacitance vs. Voltage

V_R (V)	C_T (pF)
0.0	9.0
0.5	6.7
1.0	5.2
1.5	4.0
2.0	3.2
2.5	2.6
3.0	2.2
3.5	2.0
4.0	1.9
4.5	1.8
5.0	1.8

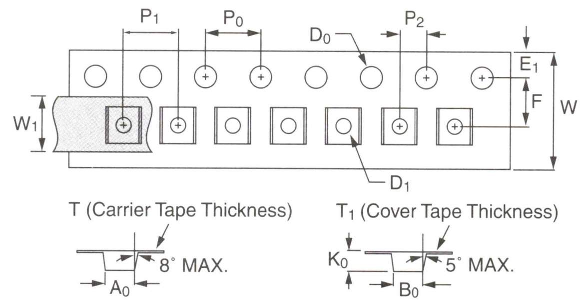
SPICE Model



Part Number	C_{J0} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1763-050	8.2	15	9.5	0.67	0.5	0.25



Paper Tape Dimensions



Description	Sym.	Chip Scale
Cavity		
Length	A_0	0.65±0.05
Width	B_0	0.76±0.05
Depth	K_0	0.53±0.05
Pitch	P_1	2.00±0.10
Bottom Hole Diameter	D_1	N/A
Perforation		
Diameter	D_0	1.50±0.10
Pitch	P_0	4.00±0.10
Position	E_1	1.75±0.10
Carrier Tape		
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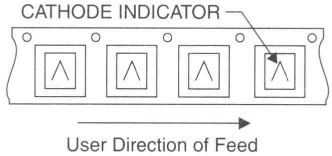
Distance		
Cavity to Perforation (Width Direction)	F	3.50±0.05
Cavity to Perforation (Length Direction)	P_2	1.00±0.025

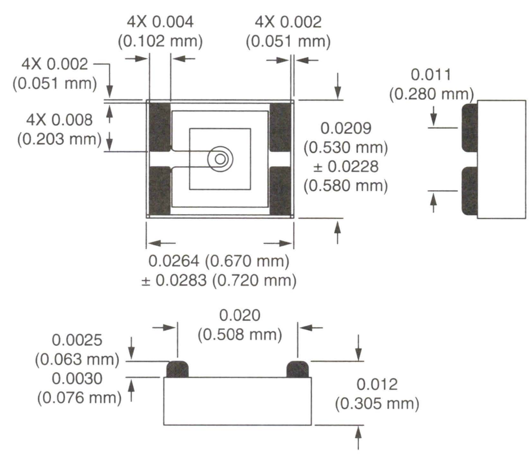
Note: All dimensions are in mm.

Chip Scale (-050)



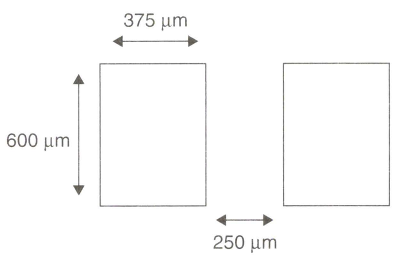
Standard Reel Size	7"
Standard Reel Quantity	12,000

-050



Land Pattern

The recommended surface mount pad pattern ensures quality solder joint formation and high-yielding assembly, while using minimum board space. The dimensions apply to both Solder Mask Defined (SMD) as well as Non-Solder Mask Defined (NSMD) pads. However, NSMD pads, in which the solder mask is pulled back from the metal pad, are preferred. This type of pad definition generally produces improved solder joint reliability as well as an increased gap under the component. The increased gap is desirable for enhanced cleaning of flux residue and component underfill for applications in which the component will be encapsulated.



Solder Printing

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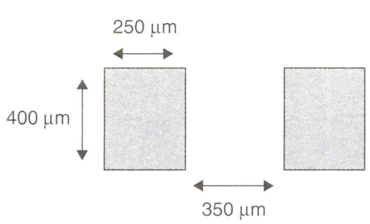
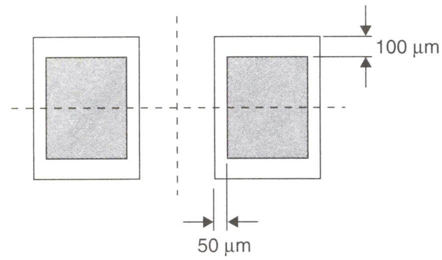


The solder deposit should be centered on the land pattern as shown.



Component Placement

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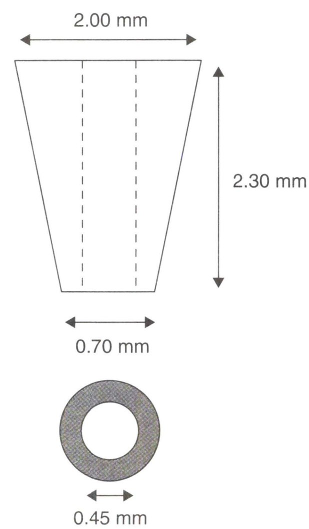
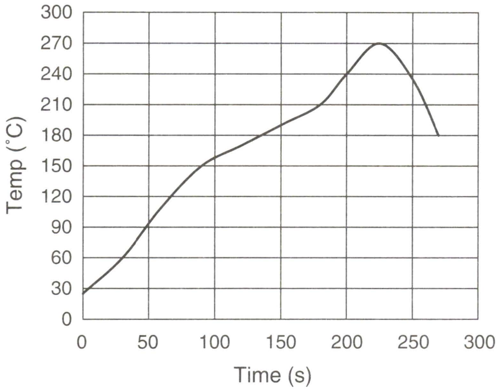


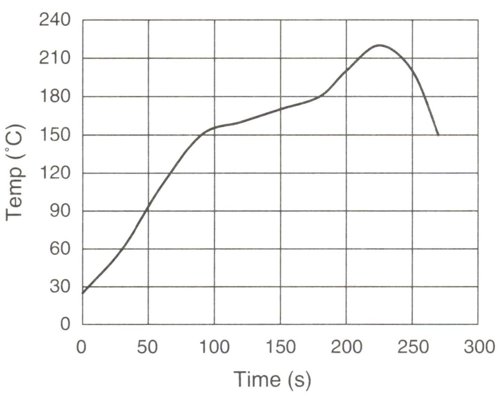
Solder Reflow

Solder reflow is best suited to convection or IR reflow systems, though convection reflow will always give more rapid and uniform thermal transfer. The CSP can be successfully reflowed in either air or nitrogen atmospheres. The solder paste manufacturer's recommended reflow profile should be adhered to and care should be taken to ensure that the profile is adjusted for variability in thermal mass amongst components. Attached are generic profiles for eutectic tin-lead solder and a typical lead-free solder.

These should only be used as a guideline, with the paste manufacturers recommended profile taking precedence. A standard solvent flux clean can be safely employed to remove flux residue from the device edges.



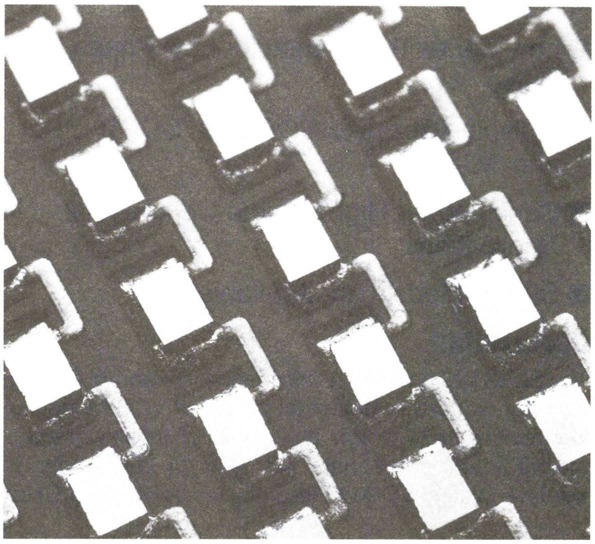
Lead Free Profile



Eutectic Tin-Lead Profile

Finished Product

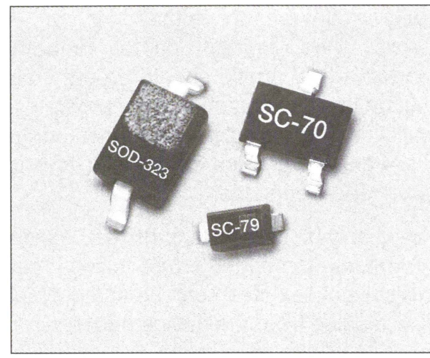
Once reflowed, the component should be fairly centered on the land pattern. Solder should wet evenly to CSP leads and the component should not display excessive tilt or skew. A solvent flux clean can be safely employed if desired.



Hyperabrupt Junction Tuning Varactors

SKYWORKS

SMV1129 and SMV1139



Features

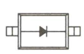
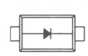
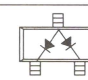
- High Q
- Low Series Resistance for Low Phase Noise
- Multiple Packages SOD-323, SC-79 and SC-70
- Designed for High Volume Commercial Applications
- SPICE Models are Available

Description

The SMV1129 and SMV1139 silicon hyperabrupt junction varactor diodes are designed for use in VCOs requiring low resistance. The low resistance of these varactors makes them appropriate for high Q resonators in wireless system VCOs to frequencies beyond 2.5 GHz.

Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

		
Single	Single	Common Anode
SOD-323	SC-79	SC-70
♦ **SMV1129-011**	♦ **SMV1129-079**	**SMV1129-073**
♦ **SMV1139-011**	♦ **SMV1139-079**	
L_S = 1.5 nH	L_S = 0.7 nH	L_S = 1.4 nH

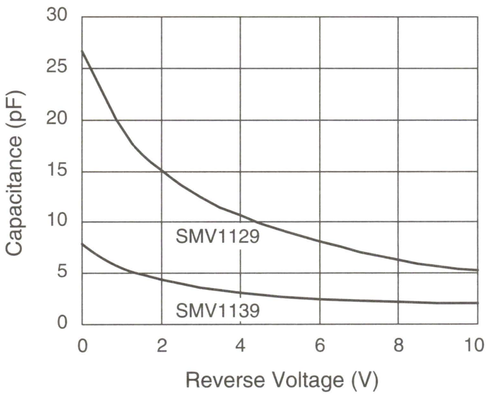
♦ Available through distribution.
For other packages or configurations, please contact the factory.

Electrical Specifications at 25°C

Part Number	C_T @ 1 V (pF)			$\frac{C_T @ 1 V}{C_T @ 3 V}$ (Ratio)		$\frac{C_T @ 1 V}{C_T @ 6 V}$ (Ratio)		R_S @ 1 V 500 MHz (Ω)
	Min.	Typ.	Max.	Min.	Typ.	Min.	Typ.	Max.
SMV1129	17.50	19.0	20.50	1.4	1.53	2.0	2.5	0.4
SMV1139	4.95	5.4	5.85	1.4	1.53	2.0	2.5	0.6

Reverse Voltage V_R (I_R = 10 µA): 12 V
Reverse Current I_R (V_R = 10 V): 20 nA

Typical Performance Data

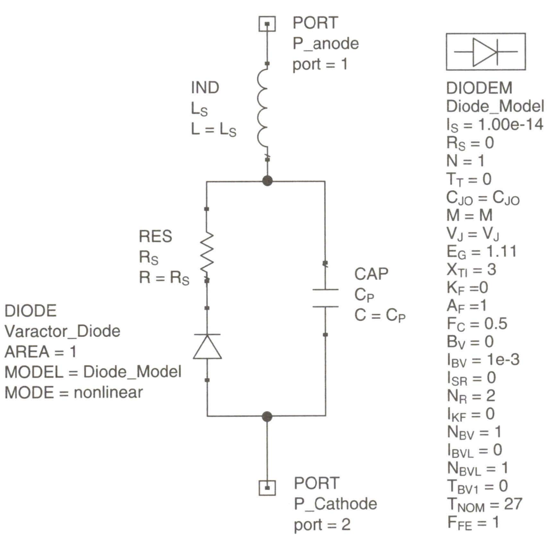


Capacitance vs. Reverse Voltage

Capacitance vs. Reverse Voltage

	SMV1129	SMV1139
V_R (V)	C_T (pF)	C_T (pF)
0	27.5	8.0
1	18.9	5.5
2	15.0	4.4
3	12.5	3.7
4	10.7	3.1
5	9.3	2.7
6	8.1	2.5
7	7.1	2.3
8	6.3	2.2
9	5.7	2.1
10	5.2	2.0
11	4.9	2.0
12	4.7	1.9

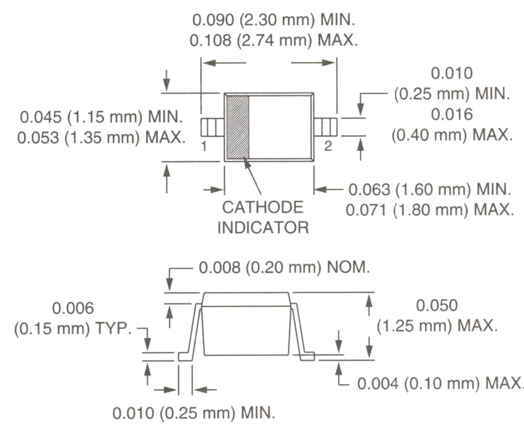
SPICE Model



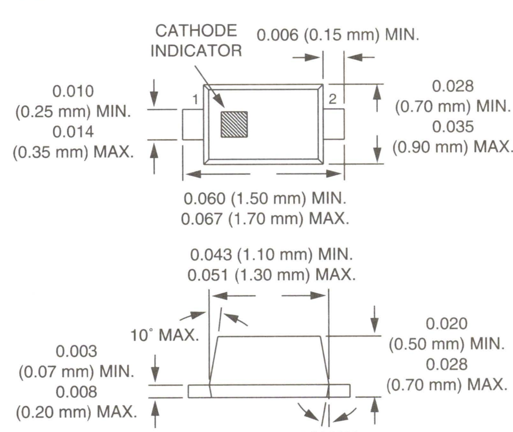
Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)
SMV1129	27.5	2.8	1.10	0	0.40
SMV1139	8.0	1.2	0.65	0	0.60

1. Values extracted from measured performance.
2. For package inductance (L_S) refer to package type.
3. For more details refer to the "Varactor SPICE Models for RF VCO Applications" Application Note.

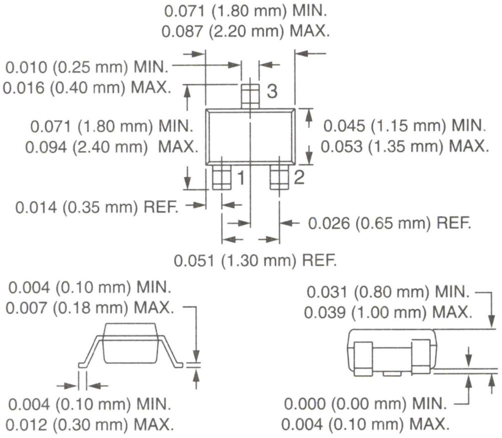
SOD-323



SC-79



SC-70

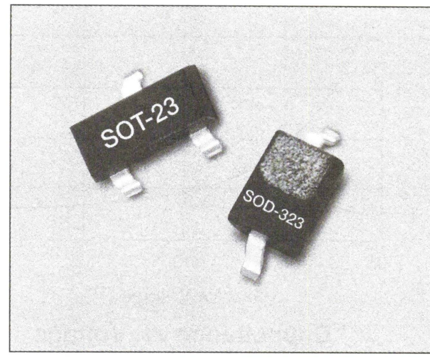


0.071 (1.80 mm) MIN.
0.087 (2.20 mm) MAX.
0.010 (0.25 mm) MIN.
0.016 (0.40 mm) MAX.
3
0.071 (1.80 mm) MIN.
0.094 (2.40 mm) MAX.
0.045 (1.15 mm) MIN.
0.053 (1.35 mm) MAX.
1
2
0.014 (0.35 mm) REF.
0.026 (0.65 mm) REF.
0.051 (1.30 mm) REF.
0.004 (0.10 mm) MIN.
0.007 (0.18 mm) MAX.
0.031 (0.80 mm) MIN.
0.039 (1.00 mm) MAX.
0.004 (0.10 mm) MIN.
0.012 (0.30 mm) MAX.
0.000 (0.00 mm) MIN.
0.004 (0.10 mm) MAX.

Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV1135 Series

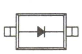
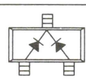


Features

- High Tuning Ratio
- Low Series Resistance
- SOD-323 Package
- Designed for High Volume, Low Cost Applications
- Available in Tape and Reel Packaging

Description

The SMV1135 series are surface mount varactor diodes designed for very high capacitance tuning ratio while having low series resistance, which makes this device especially attractive for wideband VCO applications.

	
Single	Common Cathode
SOD-323	SOT-23
SMV1135-011	**SMV1135-004**

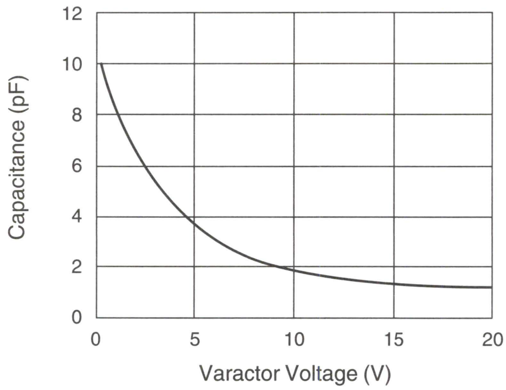
Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

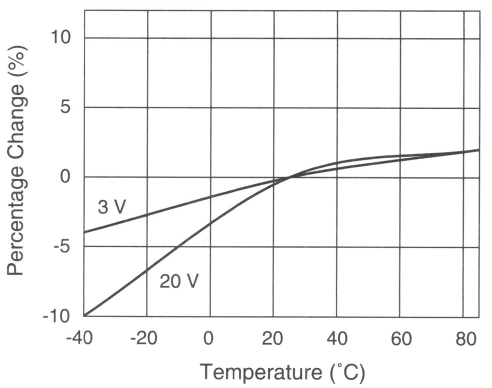
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 21 V			20.00	nA
Capacitance (C_T)	C_T @ 1 V, V_R = 1 V, F = 1 MHz	8.20		10.00	pF
Capacitance Ratio (C_{TR})	C_T (1 V)/C_T (3 V)	1.47		1.76	
Capacitance Ratio (C_{TR})	C_T (1 V)/C_T (9 V)	3.70		4.50	
Series Resistance (R_S)	V_R = 1 V, F = 500 MHz			1.20	Ω
Breakdown Voltage (V_{BR})	I_R = 10 µA	28.00			V

Typical Performance Data



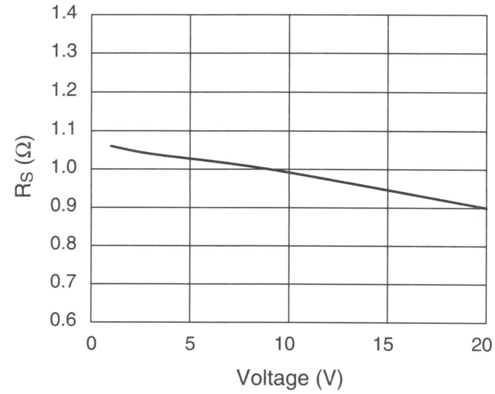
Capacitance vs. Voltage



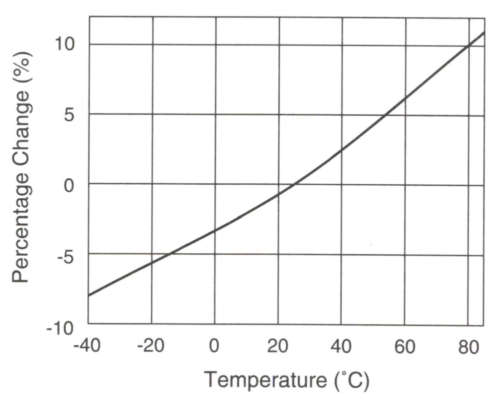
Relative Capacitance Change vs. Temperature

Capacitance vs. Voltage

V_R (V)	C_T (pF)
0.5	10.34
1.0	8.69
2.5	5.98
3.0	5.38
6.0	3.11
10.0	1.92
20.0	1.17

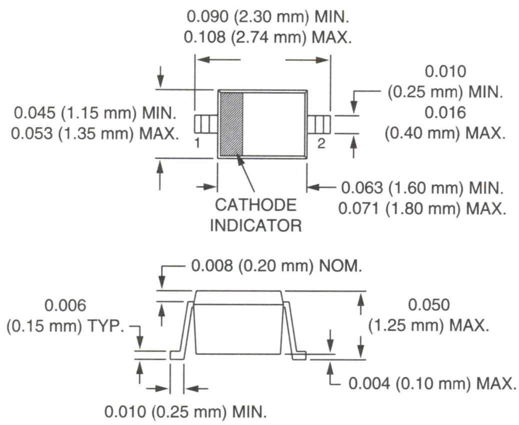


Series Resistance vs. Voltage

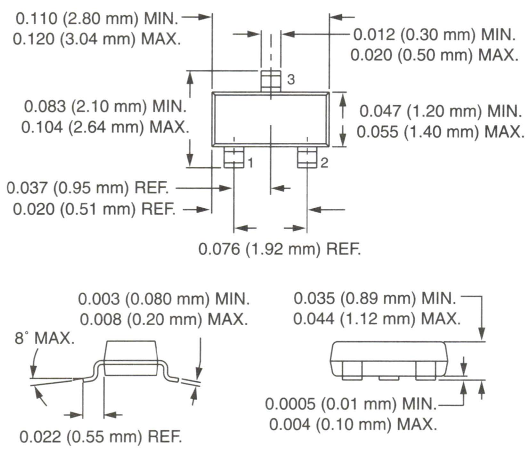


Relative Series Resistance Change vs. Temperature

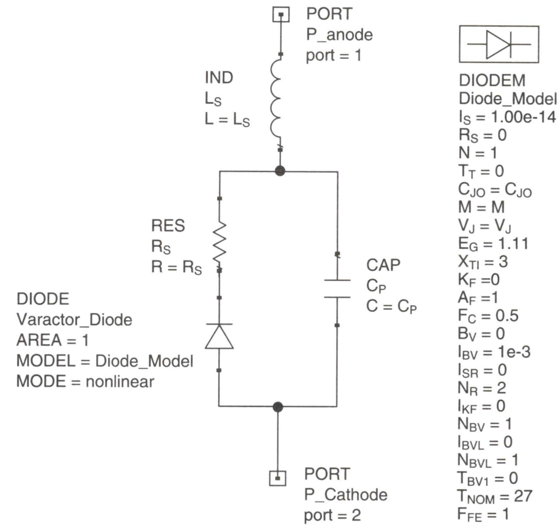
SOD-323



SOT-23



SPICE Model



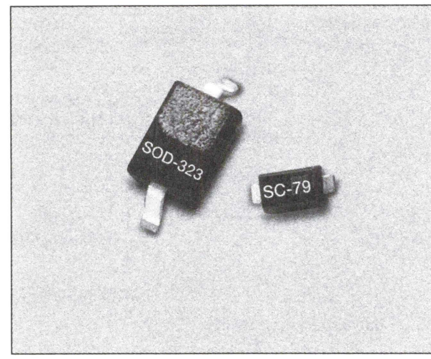
Part Number	C_{J0} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1135-011	10.3	8.6	2.9	0.8	1.2	1.5

SKYWORKS

SMV1142–SMV1148

Features

- Frequency Linear Design
- Low Series Resistance
- Available in the SOD-323 and SC-79 Packages
- Designed for High Volume Commercial Applications
- SPICE Models are Available

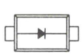
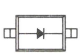


Description

The SMV1142–SMV1148 series of silicon hyperabrupt junction varactor diodes are specifically designed with an increasing gamma vs. voltage characteristic. This characteristic will result in improved VCO frequency-voltage linearity, in comparison to a conventional hyperabrupt junction varactor. This family of varactors is characterized for capacitance and resistance over temperature. SPICE models are provided.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	12 V
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

	
Single	Single
SC-79	SOD-323
	♦ **SMV1142-011**
	♦ **SMV1143-011**
	♦ **SMV1144-011**
♦ **SMV1145-079**	♦ **SMV1145-011**
	♦ **SMV1146-011**
	♦ **SMV1147-011**
	♦ **SMV1148-011**
L_S = 0.7 nH	L_S = 1.5 nH

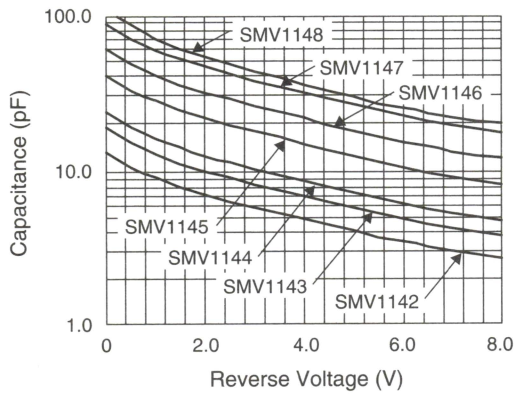
♦ Available through distribution.
For other packages or configurations, please contact the factory.

Electrical Specifications at 25°C

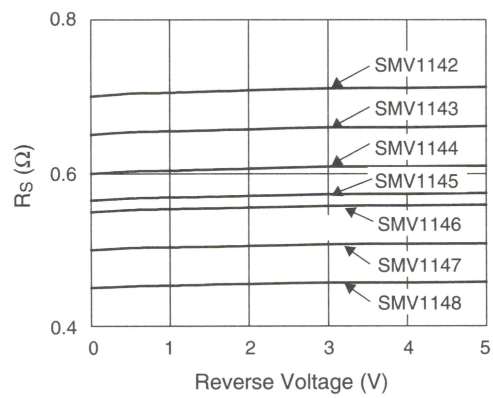
Part Number	C_T @ 1 V (pF)		C_T @ 3 V (pF)	C_T @ 6 V (pF)	$\frac{C_T @ 1 V}{C_T @ 3 V}$ (Ratio)		$\frac{C_T @ 1 V}{C_T @ 6 V}$ (Ratio)		R_S @ 3 V 500 MHz (Ω)	Q @ 3 V 50 MHz
	Min.	Max.	Typ.	Typ.	Min.	Max.	Min.	Max.	Max.	Typ.
SMV1142	8.20	10.00	5.8	3.5	1.50	1.65	2.43	2.93	0.70	800
SMV1143	11.60	14.20	8.2	4.9	1.50	1.65	2.45	2.95	0.65	600
SMV1144	14.65	17.95	10.4	6.1	1.50	1.65	2.46	2.96	0.65	500
SMV1145	25.50	31.20	18.1	10.6	1.50	1.65	2.50	3.00	0.60	300
SMV1146	37.80	46.20	26.4	15.5	1.50	1.65	2.50	3.00	0.60	200
SMV1147	54.60	66.70	38.6	22.6	1.50	1.65	2.50	3.00	0.55	150
SMV1148	62.00	76.00	44.1	25.2	1.50	1.65	2.50	3.00	0.50	150

Reverse Voltage V_R (I_R = 10 μA): 12 V
Reverse Current I_R (V_R = 9.6 V): 20 nA

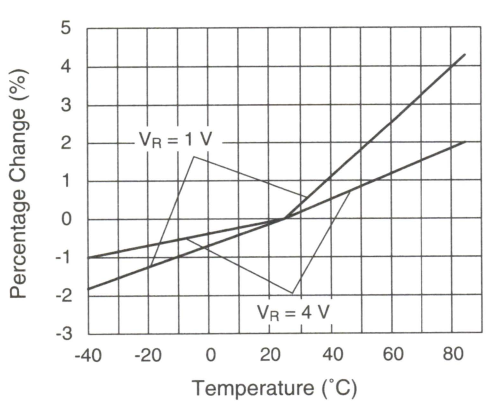
Typical Performance Data



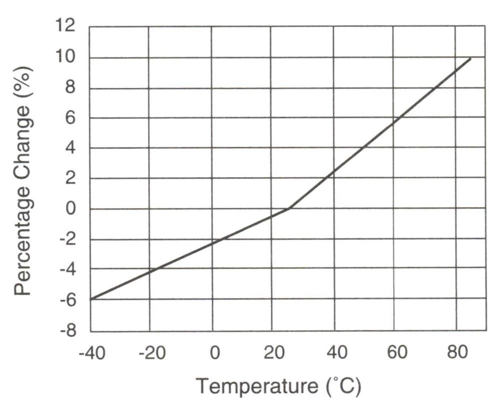
Capacitance vs. Reverse Voltage



Series Resistance vs. Reverse Voltage @ 500 MHz



Relative Capacitance Change vs. Temperature

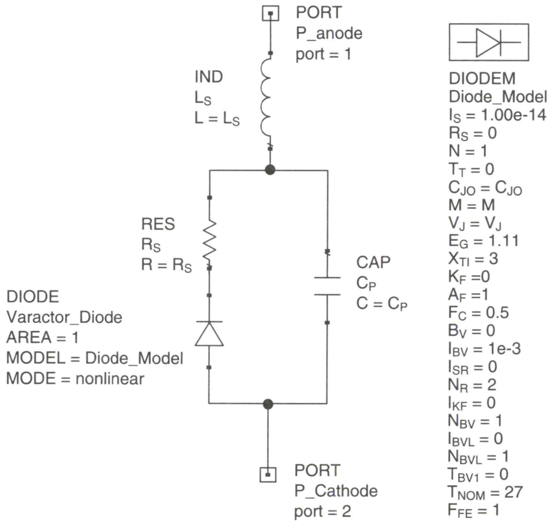


Relative Series Resistance Change vs. Temperature

Typical Capacitance Values

	SMV1142	SMV1143	SMV1144	SMV1145	SMV1146	SMV1147	SMV1148
V_R (V)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)
0.0	13.38	18.99	24.01	41.81	61.13	89.52	104.71
0.5	10.70	15.18	19.18	33.38	48.97	71.44	83.27
1.0	9.10	12.90	16.30	28.35	41.43	60.65	70.48
1.5	7.98	11.30	14.28	24.82	36.26	53.07	61.48
2.0	7.12	10.08	12.73	22.11	32.30	47.27	54.56
2.5	6.42	9.08	11.46	19.91	29.08	42.55	48.92
3.0	5.83	8.24	10.40	18.06	26.37	38.58	44.13
3.5	5.32	7.51	9.48	16.45	24.01	35.12	39.97
4.0	4.86	6.87	8.66	15.02	21.92	32.06	36.29
4.5	4.45	6.29	7.93	13.73	20.04	29.31	32.99
5.0	4.09	5.76	7.26	12.57	18.34	26.81	30.03
5.5	3.75	5.29	6.66	11.53	16.81	24.57	27.43
6.0	3.46	4.87	6.13	10.60	15.45	22.58	25.22
6.5	3.21	4.51	5.68	9.81	14.30	20.89	23.43
7.0	3.00	4.22	5.31	9.17	13.36	19.52	22.06
7.5	2.84	3.99	5.02	8.66	12.62	18.43	21.01
8.0	2.72	3.82	4.80	8.29	12.07	17.63	20.22
8.5	2.63	3.69	4.63	7.99	11.63	16.98	19.61
9.0	2.56	3.58	4.50	7.76	11.30	16.50	19.12
9.5	2.50	3.50	4.40	7.58	11.03	16.10	18.72
10.0	2.45	3.43	4.31	7.43	10.81	15.78	18.38
10.5	2.41	3.37	4.24	7.30	10.62	15.50	18.11
11.0	2.36	3.31	4.15	7.15	10.40	15.18	17.87
11.5	2.35	3.28	4.15	7.10	10.33	15.08	17.65
12.0	2.32	3.25	4.08	7.02	10.21	14.90	17.43

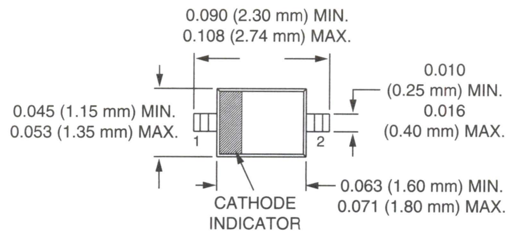
SPICE Model

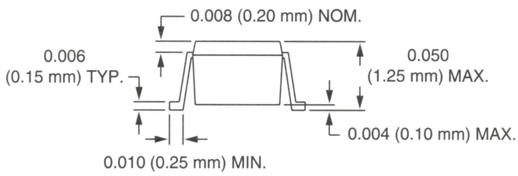


Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)
SMV1142	13.38	2.20	1.0	0	0.70
SMV1143	18.99	2.20	1.0	0	0.65
SMV1144	24.01	2.20	1.0	0	0.65
SMV1145	41.80	2.50	1.1	0	0.60
SMV1146	61.13	2.50	1.1	0	0.60
SMV1147	89.52	2.50	1.1	0	0.55
SMV1148	104.70	2.25	1.1	0	0.50

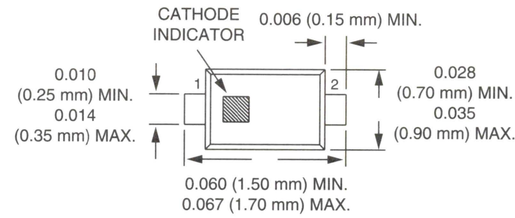
1. Values extracted from measured performance.
2. For package inductance (L_S) refer to package type.
3. For more details refer to the "Varactor SPICE Models for RF VCO Applications" Application Note.

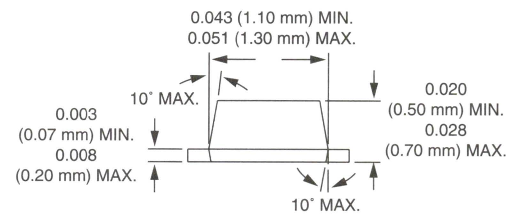
SOD-323


0.090 (2.30 mm) MIN.
0.108 (2.74 mm) MAX.
0.010
(0.25 mm) MIN.
0.016
(0.40 mm) MAX.
0.045 (1.15 mm) MIN.
0.053 (1.35 mm) MAX.
1
2
0.063 (1.60 mm) MIN.
0.071 (1.80 mm) MAX.
CATHODE
INDICATOR


0.008 (0.20 mm) NOM.
0.006
(0.15 mm) TYP.
0.050
(1.25 mm) MAX.
0.004 (0.10 mm) MAX.
0.010 (0.25 mm) MIN.

SC-79


CATHODE
INDICATOR
0.006 (0.15 mm) MIN.
0.010
(0.25 mm) MIN.
0.014
(0.35 mm) MAX.
1
2
0.028
(0.70 mm) MIN.
0.035
(0.90 mm) MAX.
0.060 (1.50 mm) MIN.
0.067 (1.70 mm) MAX.

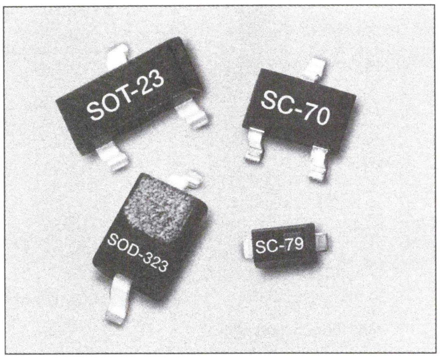

0.043 (1.10 mm) MIN.
0.051 (1.30 mm) MAX.
10° MAX.
0.003
(0.07 mm) MIN.
0.008
(0.20 mm) MAX.
0.020
(0.50 mm) MIN.
0.028
(0.70 mm) MAX.
10° MAX.

SKYWORKS

SMV1211–SMV1215

Features

- High Capacitance Ratio, $C_{1\,V}/C_{4\,V}$ = 5 Typ.
- Multiple Packages SOT-23, SOD-323, SC-70 and SC-79
- Designed for High Volume Commercial Applications
- SPICE Models are Available

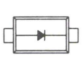
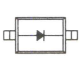
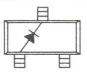
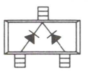
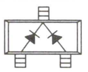


Description

The SMV1211–SMV1215 series of silicon hyperabrupt junction varactor diodes are designed for use in VCOs with low tuning voltage operation. This family of varactors is characterized for capacitance and resistance over temperature. SPICE models are provided.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	12 V
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

				
Single	Single	Single	Common Cathode	Common Cathode
SC-79	SOD-323	SOT-23	SOT-23	SC-70
		SMV1211-001		
SMV1212-079		**SMV1212-001**	**SMV1212-004**	**SMV1212-074**
SMV1213-079		**SMV1213-001**	**SMV1213-004**	**SMV1213-074**
		SMV1214-001		
	SMV1215-011	**SMV1215-001**	**SMV1215-004**	
L_S = 0.7 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.4 nH	L_S = 1.4 nH

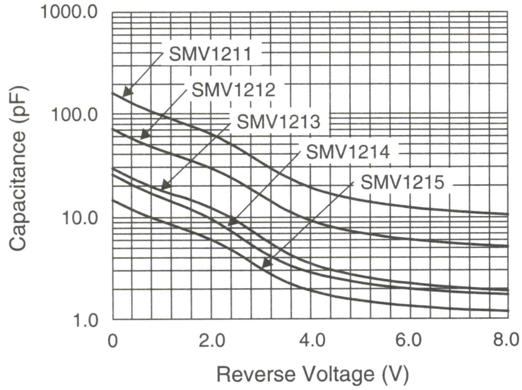
For other packages or configurations, please contact the factory.

Electrical Specifications at 25°C

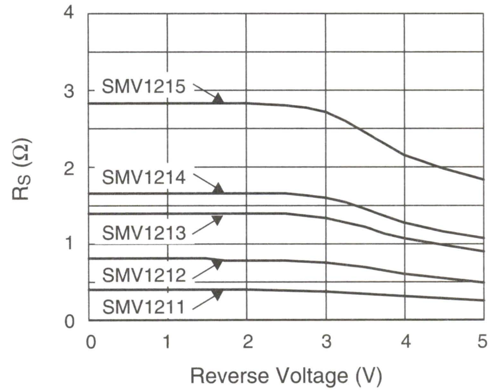
Part Number	C_T @ 1 V (pF)		C_T @ 2.5 V (pF)		C_T @ 4 V (pF)		C_T @ 1 V / C_T @ 2.5 V (Ratio)	C_T @ 1 V / C_T @ 4 V (Ratio)	R_S @ 4 V 500 MHz (Ω)	Q @ 4 V 50 MHz
	Min.	Typ.	Min.	Max.	Typ.	Max.	Typ.	Typ.	Typ.	Min.
SMV1211	95.0	100.0	40.0	65.0	20	25.0	2	5	0.4	80
SMV1212	42.0	50.0	18.0	27.0	9	12.0	2	5	0.8	150
SMV1213	17.0	22.0	8.5	10.5	4	5.5	2	5	1.4	200
SMV1214	14.5	16.0	6.5	7.8	3	4.8	2	5	1.7	300
SMV1215	8.7	9.5	4.3	5.5	2	2.9	2	5	2.8	350

Reverse Voltage V_R (I_R = 10 μA): 12 V
Reverse Current I_R (V_R = 8 V): 20 nA

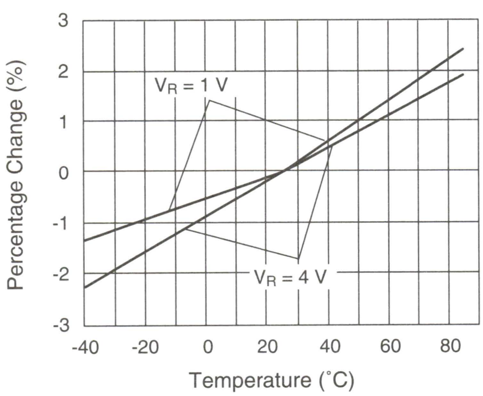
Typical Performance Data



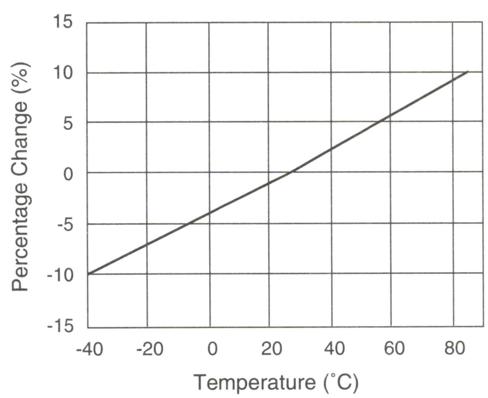
Capacitance vs. Reverse Voltage



Series Resistance vs. Reverse Voltage @ 500 MHz



Relative Capacitance Change vs. Temperature

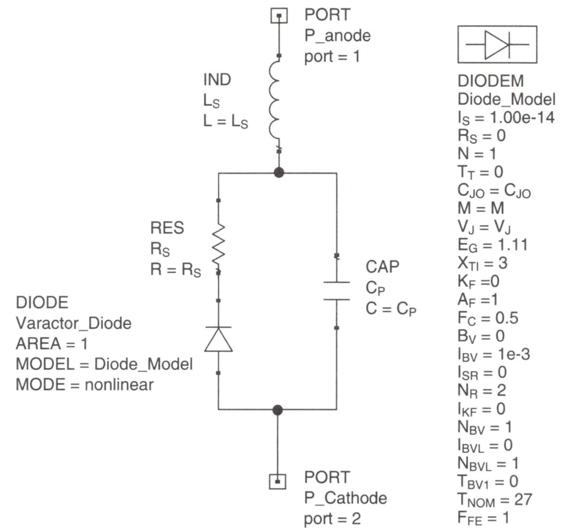


Relative Series Resistance Change vs. Temperature @ 500 MHz

Typical Capacitance Values

	SMV1211	SMV1212	SMV1213	SMV1214	SMV1215
V_R (V)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)
0.0	162.6	72.4	30.0	26.0	14.8
0.5	122.3	55.3	22.8	19.6	11.3
1.0	98.6	44.9	18.1	15.6	9.1
1.5	80.4	36.9	15.3	12.4	7.5
2.0	64.2	29.9	12.3	9.6	6.0
2.5	48.2	22.9	9.2	6.8	4.5
3.0	34.1	16.3	6.4	4.7	3.1
3.5	24.7	11.8	4.5	3.5	2.3
4.0	19.4	9.3	3.5	2.9	1.9
4.5	16.4	7.9	3.0	2.5	1.7
5.0	14.6	7.0	2.6	2.3	1.5
5.5	13.3	6.4	2.4	2.1	1.4
6.0	12.4	6.0	2.2	2.0	1.3
6.5	11.7	5.7	2.1	1.9	1.3
7.0	11.2	5.5	2.0	1.8	1.2
7.5	10.8	5.3	1.9	1.8	1.2
8.0	10.5	5.1	1.9	1.7	1.2

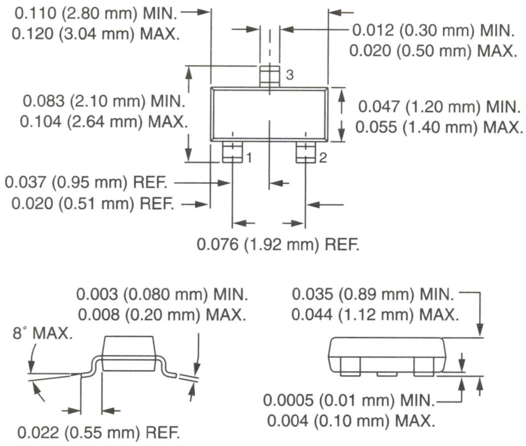
SPICE Model



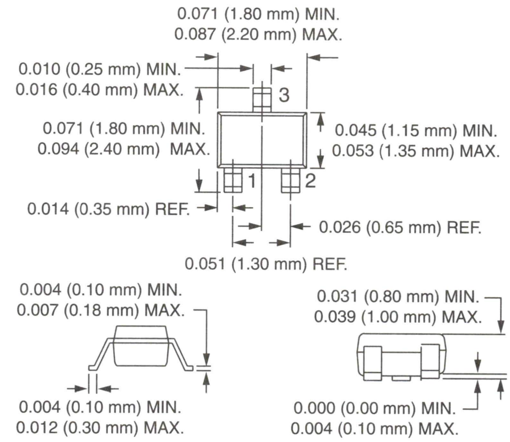
Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)
SMV1211	163.00	200	130	9.5	0.4
SMV1212	72.47	110	67	4.5	0.8
SMV1213	28.90	190	105	2.2	1.4
SMV1214	22.74	190	106	1.5	1.7
SMV1215	14.36	190	115	1.1	2.8

1. Values extracted from measured performance.
2. For package inductance (L_S) refer to package type.
3. For more details refer to the "Varactor SPICE Models for RF VCO Applications" Application Note.

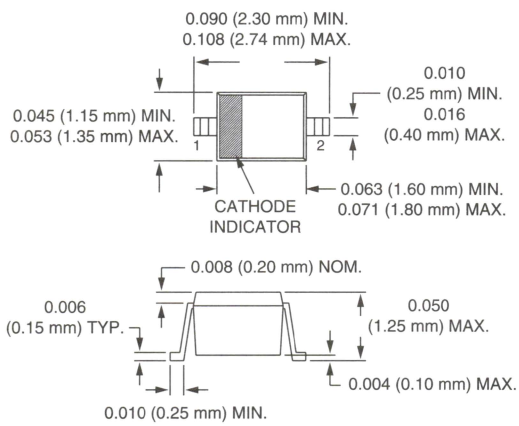
SOT-23



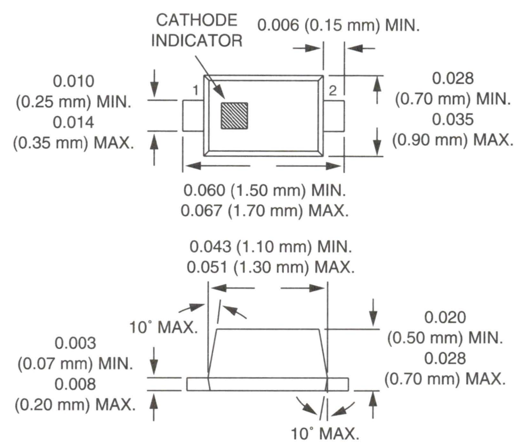
SC-70



SOD-323



SC-79

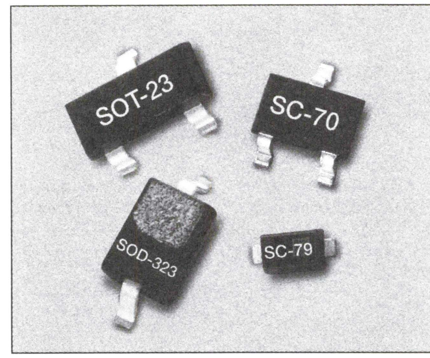


Hyperabrupt Tuning Varactors

SMV1232–SMV1237

Features

- High Capacitance Ratio, $C_{1\,V}/C_{3\,V} = 1.8$, $C_{1\,V}/C_{6\,V} = 3.1$
- Low Series Resistance for Low Phase Noise
- Multiple Packages SOT-23, SOD-323, SC-70 and SC-79
- Designed for High Volume Commercial Applications
- Full Characterization with SPICE Models

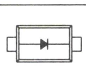
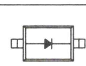
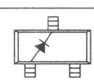
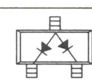
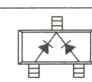
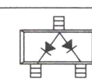
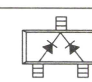


Description

The SMV1232–SMV1237 series of silicon hyperabrupt junction varactor diodes are designed for use in VCOs with low tuning voltage operation. The low resistance of these varactors makes them appropriate for high Q resonators in wireless system VCOs to frequencies beyond 2.5 GHz. The SMV1232–SMV1237 series is fully characterized for capacitance and resistance over temperature. SPICE model is provided.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	15 V
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C
ESD Human Body Model	Class 1B

						
Single	Single	Single	Common Anode	Common Cathode	Common Anode	Common Cathode
SC-79	SOD-323	SOT-23	SOT-23	SOT-23	SC-70	SC-70
♦ SMV1232-079	♦ SMV1232-011					♦ SMV1232-074
♦ SMV1233-079	♦ SMV1233-011	♦ SMV1233-001	♦ SMV1233-003	♦ SMV1233-004	♦ SMV1233-073	♦ SMV1233-074
♦ SMV1234-079	♦ SMV1234-011	♦ SMV1234-001	♦ SMV1234-003	♦ SMV1234-004	♦ SMV1234-073	♦ SMV1234-074
♦ SMV1235-079	♦ SMV1235-011	♦ SMV1235-001		♦ SMV1235-004		♦ SMV1235-074
♦ SMV1236-079	♦ SMV1236-011	♦ SMV1236-001		♦ SMV1236-004		♦ SMV1236-074
		♦ SMV1237-001		♦ SMV1237-004		♦ SMV1237-074
L_S = 0.7 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.4 nH	L_S = 1.4 nH

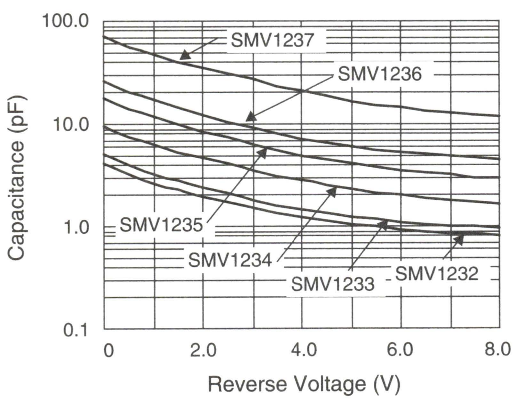
♦ Available through distribution.
For other packages or configurations, please contact the factory.

Electrical Specifications at 25°C

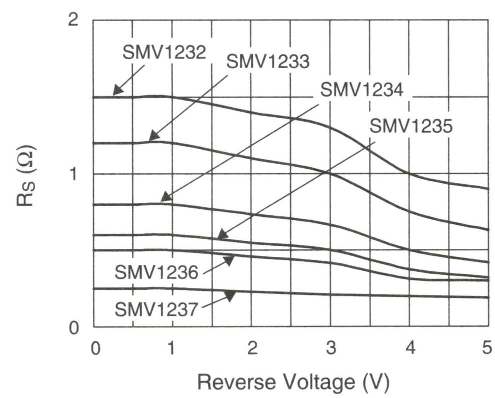
Part Number	C_T @ 1 V (pF)		C_T @ 3 V (pF)	C_T @ 6 V (pF)	C_T @ 1 V / C_T @ 3 V (Ratio)		C_T @ 1 V / C_T @ 6 V (Ratio)		R_S @ 3 V 500 MHz (Ω)	Q @ 3 V 50 MHz
	Min.	Max.	Typ.	Typ.	Min.	Max.	Min.	Max.	Max.	Typ.
SMV1232	2.34	2.86	1.5	0.94	1.5	1.9	2.6	3.3	1.50	1400
SMV1233	3.00	3.60	1.8	1.10	1.5	1.9	2.6	3.3	1.20	1200
SMV1234	5.85	7.15	3.6	2.00	1.6	2.0	2.8	3.4	0.80	1000
SMV1235	10.35	12.65	6.4	3.60	1.6	2.0	2.9	3.4	0.60	750
SMV1236	15.50	18.50	9.2	5.30	1.6	2.0	3.0	3.5	0.50	700
SMV1237	45.00	54.00	26.9	14.40	1.6	2.0	3.0	3.5	0.25	500

Reverse Voltage V_R (I_R = 10 μA): 15 V
Reverse Current I_R (V_R = 12 V): 20 nA

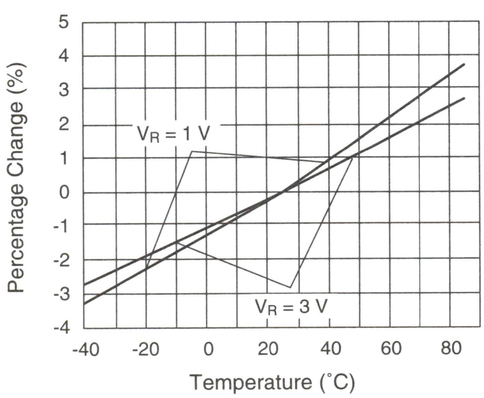
Typical Performance Data



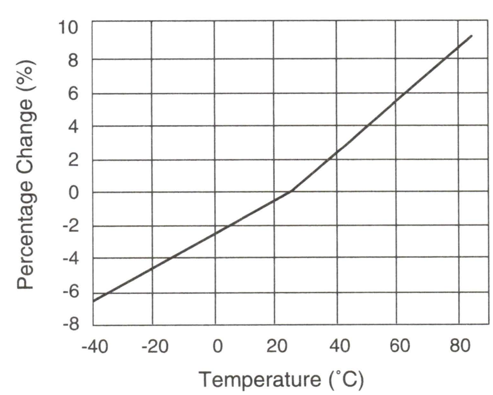
Capacitance vs. Reverse Voltage



Series Resistance vs. Reverse Voltage @ 500 MHz



Relative Capacitance Change vs. Temperature

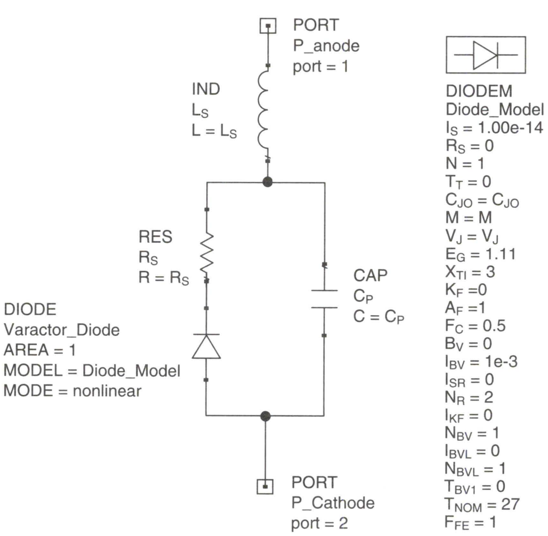


Relative Series Resistance Change vs. Temperature @ 500 MHz

Typical Capacitance Values

	SMV1232	SMV1233	SMV1234	SMV1235	SMV1236	SMV1237
V_R (V)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)
0.0	4.15	5.08	9.63	18.22	26.75	71.82
0.5	3.22	3.95	7.53	14.12	20.61	56.10
1.0	2.67	3.28	6.28	11.67	17.02	46.89
1.5	2.28	2.80	5.39	9.91	14.38	40.33
2.0	1.97	2.41	4.68	8.52	12.29	35.13
2.5	1.72	2.09	4.09	7.36	10.56	30.71
3.0	1.51	1.82	3.58	6.40	9.16	26.87
3.5	1.35	1.62	3.15	5.62	8.04	23.57
4.0	1.22	1.45	2.81	4.99	7.19	20.83
4.5	1.13	1.33	2.54	4.50	6.53	18.62
5.0	1.05	1.24	2.32	4.11	6.01	16.87
5.5	0.99	1.16	2.15	3.80	5.61	15.48
6.0	0.94	1.10	2.02	3.55	5.28	14.36
6.5	0.90	1.05	1.90	3.34	5.02	13.46
7.0	0.86	1.01	1.80	3.17	4.81	12.72
7.5	0.84	0.98	1.72	3.03	4.64	12.11
8.0	0.81	0.96	1.65	2.91	4.49	11.61
9.0	0.78	0.92	1.55	2.73	4.28	10.87
10.0	0.76	0.90	1.47	2.61	4.13	10.38
11.0	0.75	0.88	1.42	2.53	4.02	10.06
12.0	0.74	0.87	1.38	2.47	3.95	9.84
13.0	0.73	0.86	1.35	2.43	3.89	9.68
14.0	0.73	0.85	1.33	2.40	3.84	9.56
15.0	0.72	0.84	1.32	2.38	3.80	9.47

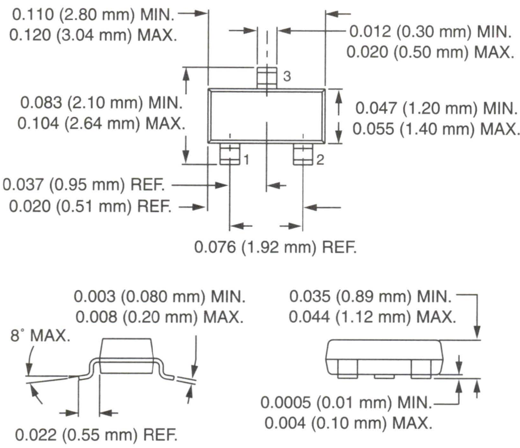
SPICE Model



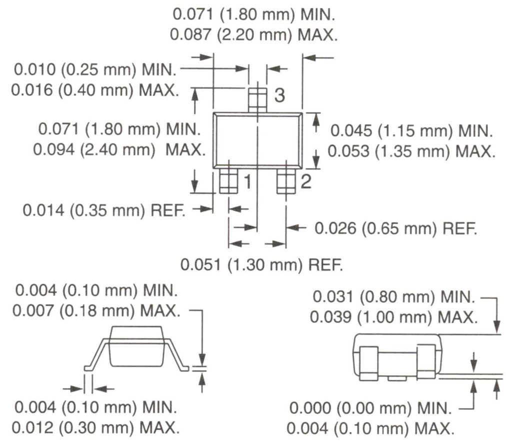
Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)
SMV1232	4.20	1.7	0.9	0.0	1.50
SMV1233	4.12	1.7	0.9	0.7	1.20
SMV1234	8.75	2.3	1.1	1.2	0.80
SMV1235	16.13	8.0	4.0	2.0	0.60
SMV1236	21.63	8.0	4.2	3.2	0.50
SMV1237	66.16	10.0	5.3	9.0	0.25

1. Values extracted from measured performance.
2. For package inductance (L_S) refer to package type.
3. For more details refer to the "Varactor SPICE Models for RF VCO Applications" Application Note.

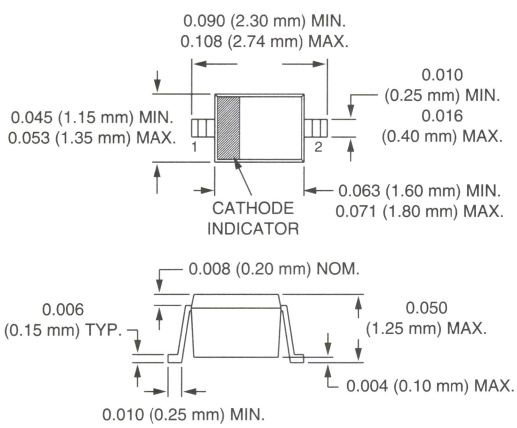
SOT-23



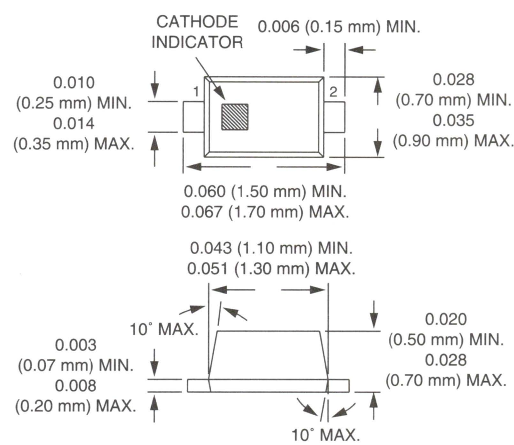
SC-70



SOD-323



SC-79



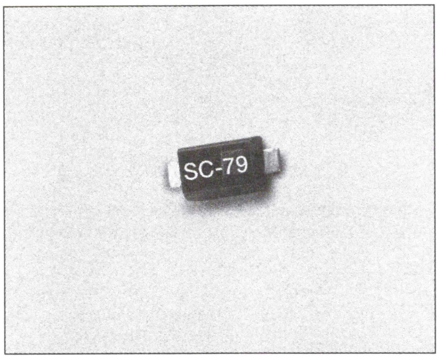
Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV1238-079

Features

- Low Series Resistance
- High Capacitance Ratio at Low Reverse Voltage
- Ultra Small SC-79 Package
- Designed for High Volume, Low Cost Battery Applications
- Available in Tape and Reel Packaging



Description

The SMV1238-079 is a silicon hyperabrupt junction varactor diode. The specified high capacitance ratio of this varactor makes it attractive for wideband VCO applications.

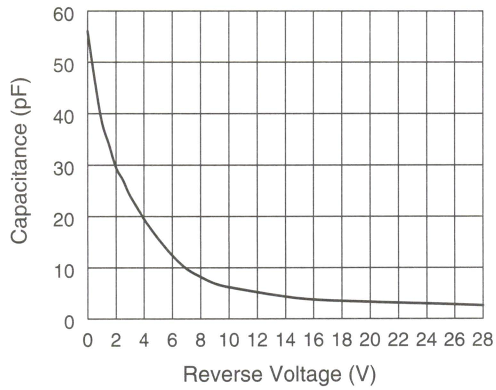
Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	30 V
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

Electrical Specifications at 25°C

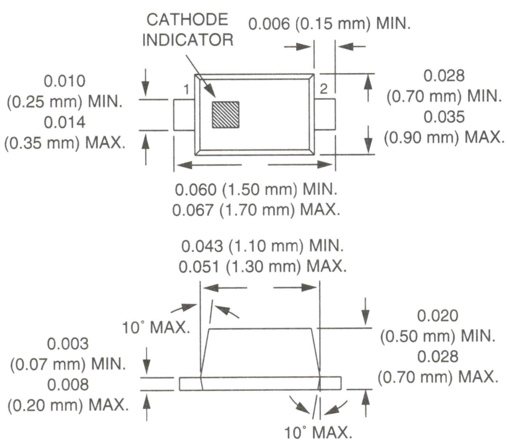
Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 24 V			20.0	nA
Capacitance (C_T)	C_T @ 1.0 V, V_R = 1.0 V, F = 1 MHz	36.0		42.0	pF
Capacitance (C_T)	C_T @ 28 V, V_R = 28 V, F = 1 MHz	2.4		3.0	pF
Capacitance Ratio (C_{TR})	C_T (1.0 V)/C_T (28 V)	12.0			
Series Resistance (R_S)	V_R = 5 V, F = 500 MHz		0.75	0.85	Ω
Breakdown Voltage (V_{BR})	I_R = 10 µA	30.0			V

Typical Performance Data



Capacitance vs. Reverse Voltage

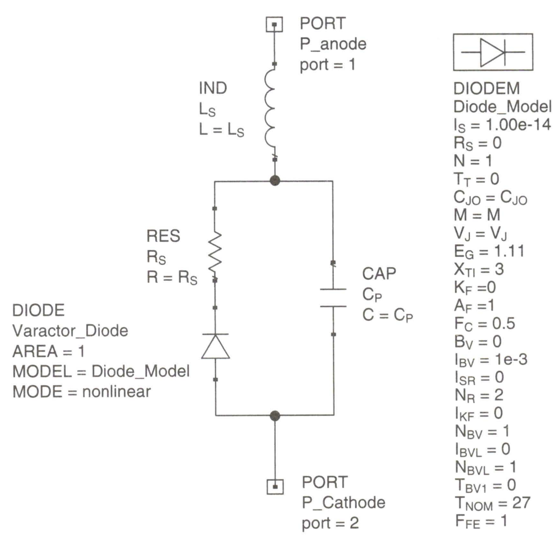
SC-79



Capacitance vs. Voltage

V_R (V)	C_T (pF)
0	56.0
0.5	46.5
1.0	38.4
1.5	34.0
2.0	29.5
2.5	27.0
3.0	24.0
4.0	19.5
5.0	15.7
6.0	12.4
7.0	9.8
8.0	8.2
9.0	6.9
10.0	6.2
15.0	4.0
20.0	3.3
25.0	2.9
28.0	2.6

SPICE Model



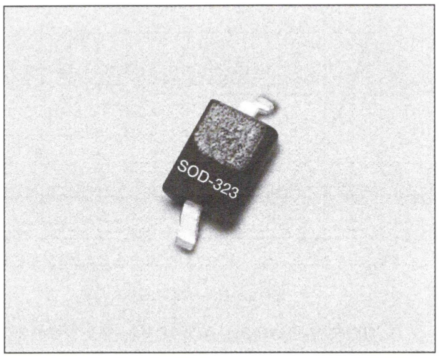
Part Number	C_{J0} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1238-079	56	6.0	2.4	1.2	0.75	0.7

Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV1245-011

Features
- High Tuning Ratio
- Low Series Resistance
- SOD-323 Package
- Designed for High Volume, Low Cost Applications
- Available in Tape and Reel Packaging



Description
The SMV1245-011 is a surface mount varactor diode in the SOD-323 plastic package. It is designed for very low series resistance applications such as RF and microwave VCOs.

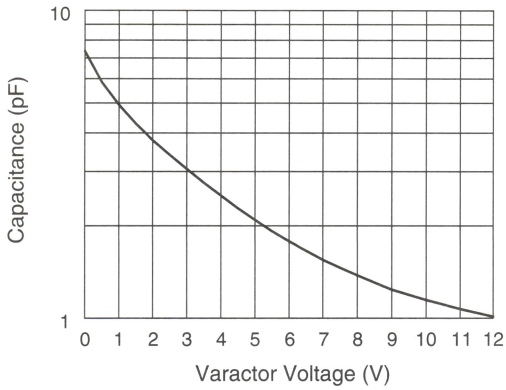
Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

Electrical Specifications at 25°C

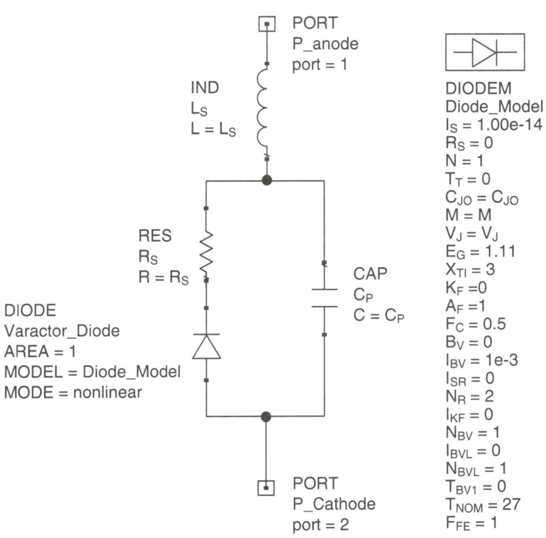
Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 10 V			20.00	nA
Capacitance (C_T)	C_T @ 1 V, V_R = 1 V, F = 1 MHz	4.40		5.40	pF
Capacitance Ratio (C_{TR})	C_T (1 V)/C_T (3 V)	1.47		1.76	
Capacitance Ratio (C_{TR})	C_T (1 V)/C_T (9 V)	3.50		4.20	
Series Resistance (R_S)	V_R = 1 V, F = 500 MHz			2.00	Ω
Breakdown Voltage (V_{BR})	I_R = 10 μA	26.00			V

Typical Performance Data



Capacitance vs. Voltage

SPICE Model

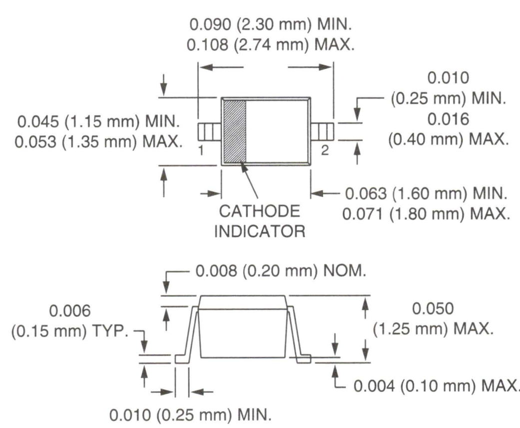


Part Number	C_{J0} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1245-011	6.9	3.5	1.7	0.47	2.0	1.7

Capacitance vs. Voltage

V_R (V)	C_T (pF)
0.0	7.37
0.5	5.84
1.0	4.93
1.5	4.28
2.0	3.79
2.5	3.40
3.0	3.06
3.5	2.76
4.0	2.51
4.5	2.28
5.0	2.09
5.5	1.92
6.0	1.78
6.5	1.66
7.0	1.55
7.5	1.46
8.0	1.38
8.5	1.32
9.0	1.26
9.5	1.20
10.0	1.16
10.5	1.12
11.0	1.08
11.5	1.05
12.0	1.02

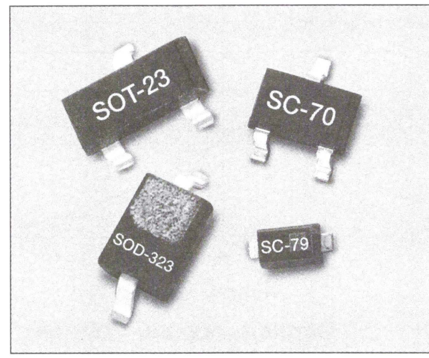
SOD-323



SMV1247–SMV1255

Features

- Designed for High Volume Commercial Applications
- High Capacitance Ratio, $C_{0.3\,V}/C_{4.7\,V}$ = 12 Typ.
- Multiple Packages SOT-23, SOD-323, SC-70 and SC-79
- Available Lead (Pb)-Free MSL-1 @ 250°C per JEDEC J-STD-020
- SPICE Models are Available
- Available in Tape and Reel Packaging



Description

The SMV1247–SMV1255 series of silicon hyperabrupt junction varactor diodes are designed for use in VCOs with low tuning voltage operation. This family of varactors is characterized for capacitance and resistance over temperature. SPICE models are provided.

NEW Lead (Pb)-Free "environmentally friendly" packaging available: Skyworks offers the SMV1247-079LF Lead (Pb)-Free package as a green alternative.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	15 V
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

Single	Single	Single	Common Anode	Common Cathode	Common Anode	Common Cathode
SC-79	SOD-323	SOT-23	SOT-23	SOT-23	SC-70	SC-70
SMV1247-079						**SMV1247-074**
SMV1247-079LF		**SMV1248-001**				
SMV1249-079	**SMV1249-011**	**SMV1249-001**	**SMV1249-003**		**SMV1249-073**	
SMV1251-079	**SMV1251-011**	**SMV1251-001**		**SMV1251-004**		**SMV1251-074**
SMV1253-079				**SMV1253-004**		
SMV1255-079	**SMV1255-011**	**SMV1255-001**		**SMV1255-004**	**SMV1255-073**	
L_S = 0.7 nH	L_S = 1.5 nH	L_S = 1.5 nH		L_S = 1.5 nH	L_S = 1.4 nH	L_S = 1.4 nH

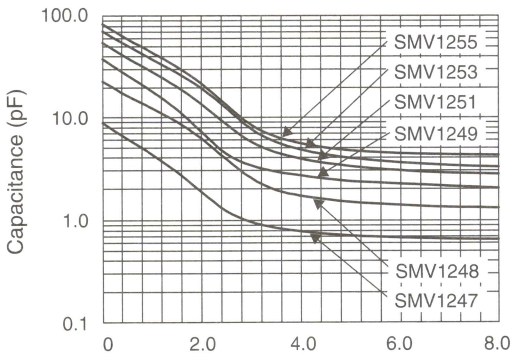
LF denotes Lead (Pb)-Free packaging.

Electrical Specifications at 25°C

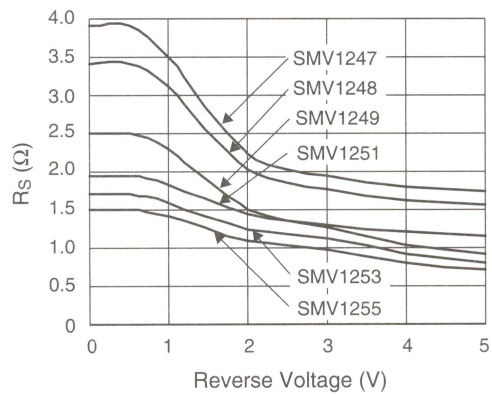
Part Number	C_T @ 0.3 V (pF)		C_T @ 4.7 V (pF)		C_T @ 1 V (pF)	C_T @ 3 V (pF)	$\frac{C_T @ 0.3 V}{C_T @ 4.7 V}$ (Ratio)		$\frac{C_T @ 1 V}{C_T @ 3 V}$ (Ratio)	R_S @ 3 V 500 MHz (Ω)	Q @ 3 V 50 MHz
	Min.	Typ.	Typ.	Max.	Typ.	Typ.	Min.	Typ.	Typ.	Max.	Typ.
SMV1247	6.5	7	0.7	0.78	4.4	0.95	9.5	10.0	4.6	2.0	1500
SMV1248	15.0	17	1.5	1.70	12.3	2.60	10.8	12.0	4.7	1.8	700
SMV1249	28.0	31	2.6	2.80	18.2	3.40	11.0	12.1	5.3	1.5	600
SMV1251	38.0	42	3.4	3.80	28.1	5.80	11.0	12.2	4.8	1.3	400
SMV1253	48.0	53	4.3	4.80	37.0	7.80	11.0	12.3	4.7	1.2	350
SMV1255	58.0	64	5.2	5.80	43.3	8.50	11.0	12.3	5.1	1.0	350

Reverse Voltage V_R (I_R = 10 µA): 15 V
Reverse Current I_R (V_R = 12 V): 20 nA

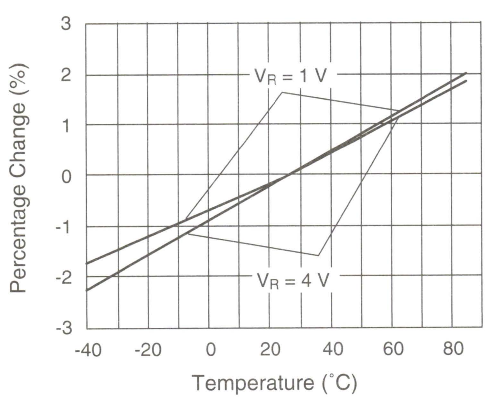
Typical Performance Data



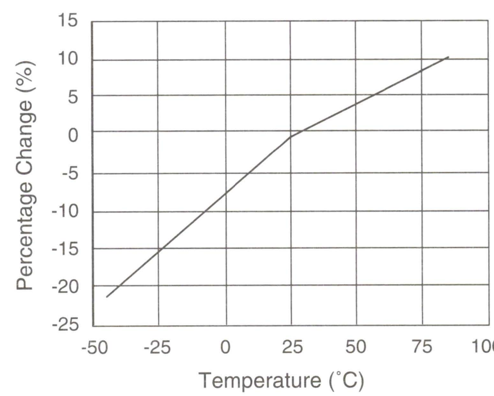
Capacitance vs. Reverse Voltage



Series Resistance vs. Reverse Voltage @ 500 MHz



Relative Capacitance Change vs. Temperature

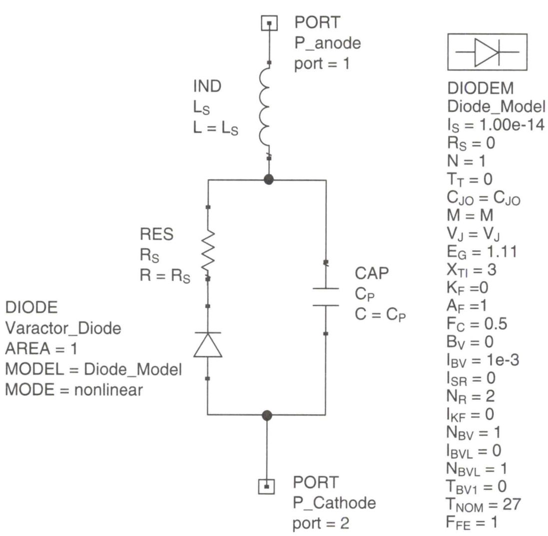


Relative Series Resistance Change vs. Temperature @ 500 MHz

Typical Capacitance Values

	SMV1247	SMV1248	SMV1249	SMV1251	SMV1253	SMV1255
V_R (V)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)
0.0	8.86	22.62	37.35	53.65	69.32	81.21
0.5	6.17	16.32	25.88	38.23	50.23	58.28
1.0	4.37	12.33	18.18	28.09	37.07	43.27
1.5	2.96	9.12	12.08	20.13	27.57	31.49
2.0	1.88	6.27	7.27	13.55	19.37	21.50
2.5	1.22	3.93	4.44	8.60	12.39	13.40
3.0	0.95	2.57	3.40	5.78	7.77	8.51
3.5	0.83	1.95	2.96	4.57	5.77	6.51
4.0	0.77	1.71	2.72	3.95	4.86	5.58
4.5	0.73	1.59	2.51	3.58	4.34	5.07
5.0	0.70	1.49	2.38	3.33	4.01	4.76
5.5	0.68	1.44	2.30	3.16	3.78	4.58
6.0	0.67	1.40	2.24	3.03	3.62	4.46
6.5	0.66	1.36	2.19	2.94	3.50	4.39
7.0	0.65	1.33	2.14	2.88	3.41	4.33
7.5	0.64	1.31	2.09	2.83	3.34	4.29
8.0	0.64	1.30	2.03	2.79	3.28	4.26

SPICE Model



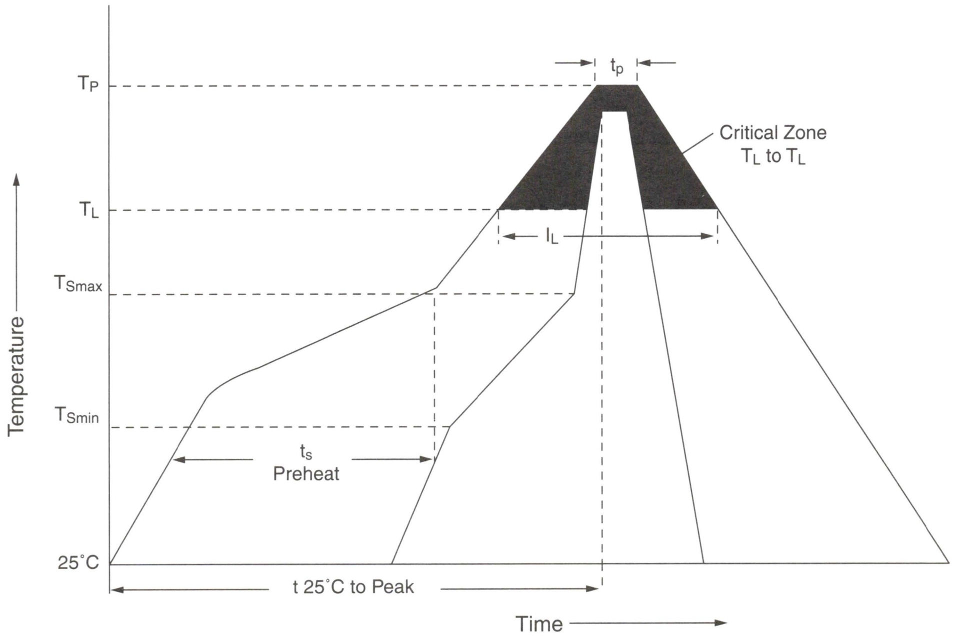
Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)
SMV1247	9.22	13	10.5	0	2.0
SMV1248	21.54	13	10.5	0	1.8
SMV1249	39.00	17	14.0	0	1.5
SMV1250	47.00	17	14.0	0	1.5
SMV1251	60.00	17	14.0	0	1.3
SMV1253	70.00	17	14.0	0	1.2
SMV1255	82.00	17	13.0	0	1.0

1. Model was designed to fit measured data in the range of up to 4 V.
2. For package inductance (L_S) refer to package type.
3. For more details refer to the "Varactor SPICE Models for RF VCO Applications" Application Note.

Recommended Solder Reflow Profiles

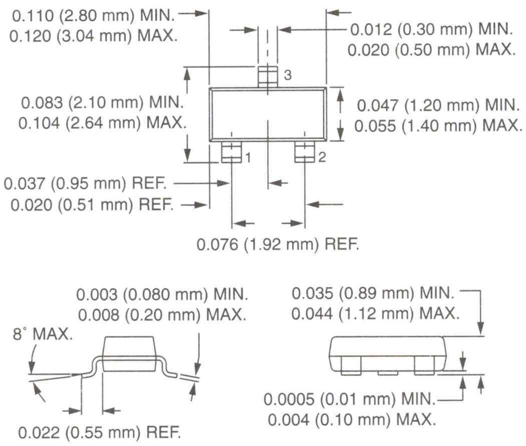
Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average Ramp-Up Rate (T_L to T_P)	3°C/Second Max.	3°C/Second Max.
Preheat Temperature Min. (T_{Smin}) Temperature Max. (T_{Smax}) Time (Min. to Max.) (ts)	 100°C 150°C 60–120 Seconds	 150°C 200°C 60–80 Seconds
T_{Smax} to T_L Ramp-up Rate	 —	 3°C/Second Max.
Time Maintained Above: Temperature (T_L) Time (t_L)	 183°C 60–150 Seconds	 217°C 60–150 Seconds
Peak Temperature (T_P)	240 +0/-5°C	250 +0/-5°C
Time Within 5°C of Actual Peak Temperature (tp)	10–30 Seconds	20–40 Seconds
Ramp-Down Rate	6°C/Second Max.	6°C/Second Max.
Time 25°C to Peak Temperature	6 Minutes Max.	8 Minutes Max.

All temperatures refer to the topside of the package, measured on the package body surface.
Reference JEDEC J-STD-020B.

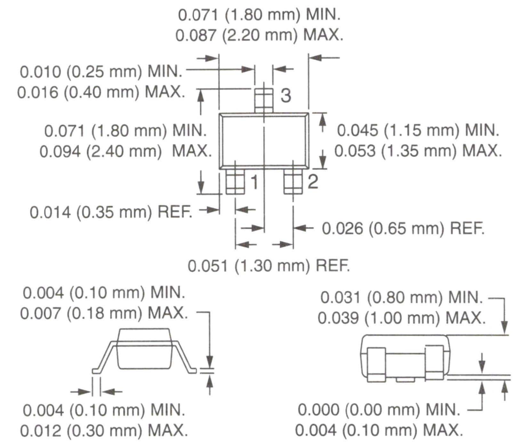


Reference JEDEC J-STD-020

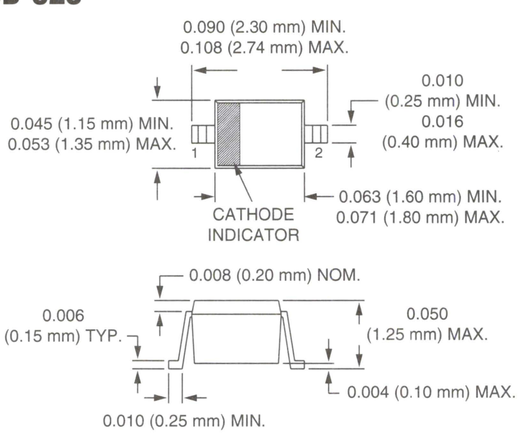
SOT-23



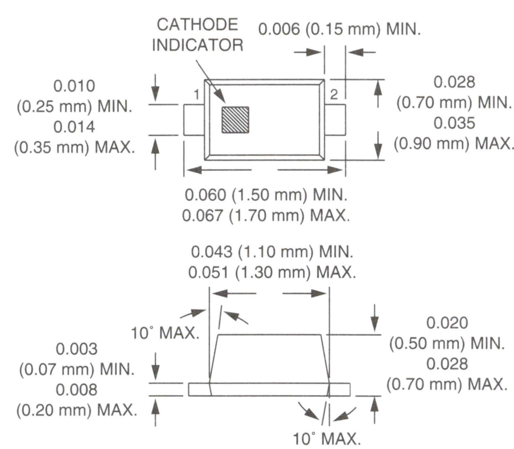
SC-70



SOD-323



SC-79



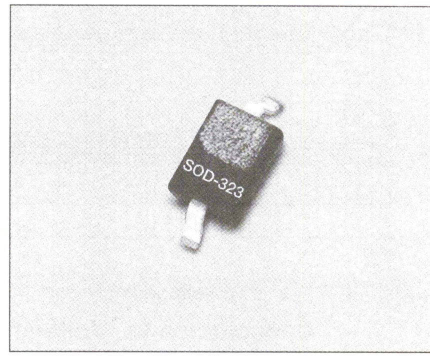
Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV1265-011

Features

- High Tuning Ratio
- Low Series Resistance
- SOD-323 and SC-79 Packages
- Designed for High Volume, Low Cost Applications
- Available in Tape and Reel Packaging



Description

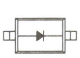
The SMV1265-011 is designed for very high capacitance tuning ratio while having low series resistance, which makes this device especially attractive for wide band VCO applications.

Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

Electrical Specifications at 25°C

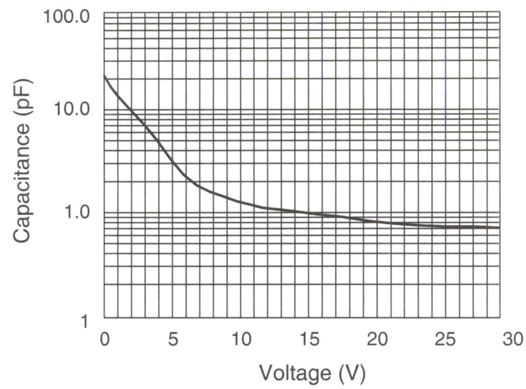
Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 26 V			20.00	nA
Capacitance (C_T)	C_T @ 1 V, V_R = 1 V, F = 1 MHz	12.50	13.8	14.70	pF
Capacitance (C_T)	C_T @ 26 V, V_R = 26 V, F = 1 MHz	0.58	0.7	0.83	pF
Capacitance Ratio (C_{TR})	C_T (1 V)/C_T (26 V)	17.70	19.5		
Series Resistance (R_S)	V_R = 1 V, F = 470 MHz		2.4		Ω
Breakdown Voltage (V_{BR})	I_R = 10 µA	28.00			V



Single
SOD-323
♦ **SMV1265-011**
L_S = 1.5 nH

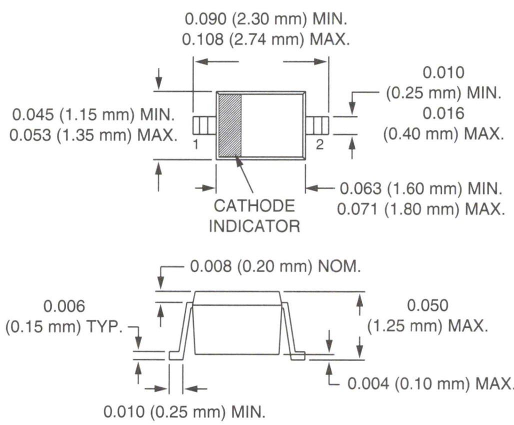
♦ Available through distribution.
For other packages or configurations, please contact the factory.

Typical Performance Data



Capacitance vs. Voltage

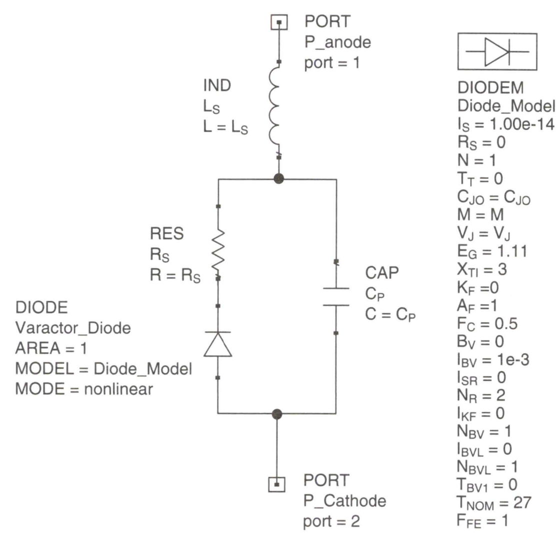
SOD-323



Capacitance vs. Voltage

V_R (V)	C_T (pF)
0.0	22.47
0.5	17.41
1.0	14.26
2.0	10.23
3.0	7.40
4.0	5.15
5.0	3.38
6.0	2.37
7.0	1.86
8.0	1.61
9.0	1.45
10.0	1.30
12.0	1.12
14.0	1.05
16.0	0.97
18.0	0.91
20.0	0.83
22.0	0.78
24.0	0.75
26.0	0.73
28.0	0.73
30.0	0.71

SPICE Model

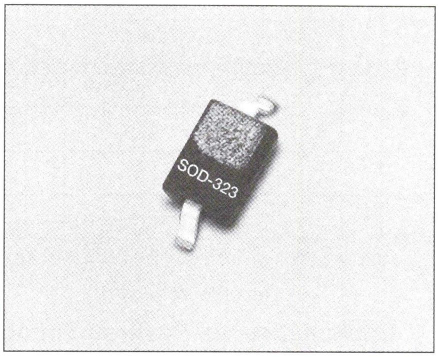


Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1265	22.5	30	13	0.71	2.4	1.7

SMV1281-011

Features

- High Tuning Ratio
- SOD-323 Package
- Designed for High Volume, Low Cost Applications
- Available in Tape and Reel Packaging



Description

The SMV1281-011 is a surface mount varactor diode in the SOD-323 plastic package. It is designed for very high capacitance tuning ratio while having low series resistance, which makes this device especially attractive for wideband VCO applications.

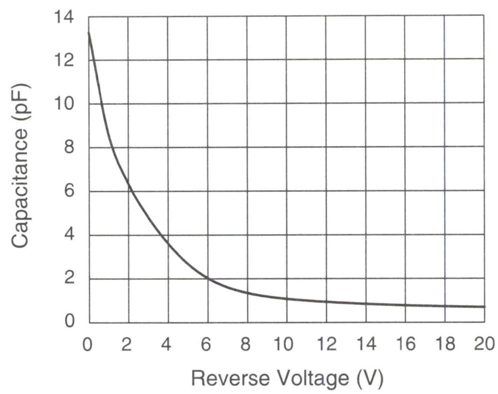
Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

Electrical Specifications at 25°C

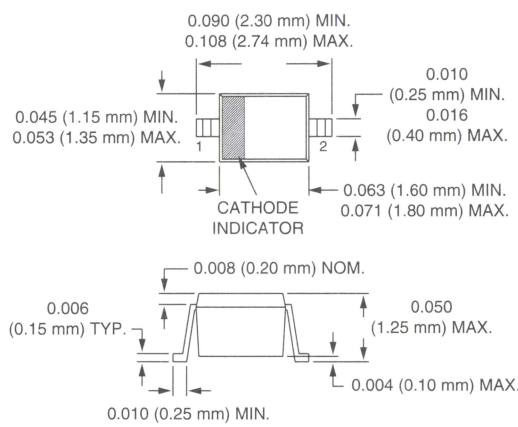
Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 20 V			20.0	nA
Capacitance (C_T)	1 V	7.8	8.6	9.5	pF
Capacitance (C_T)	20 V	0.6	0.7	0.8	pF
Capacitance Ratio (C_{TR})	1 V/20 V		12.0		
Series Resistance (R_S)	V_R = 1 V, F = 500 MHz		1.7		Ω
Breakdown Voltage (V_{BR})	I_R = 10 μA	24.0			V

Typical Performance Data



Capacitance vs. Reverse Voltage

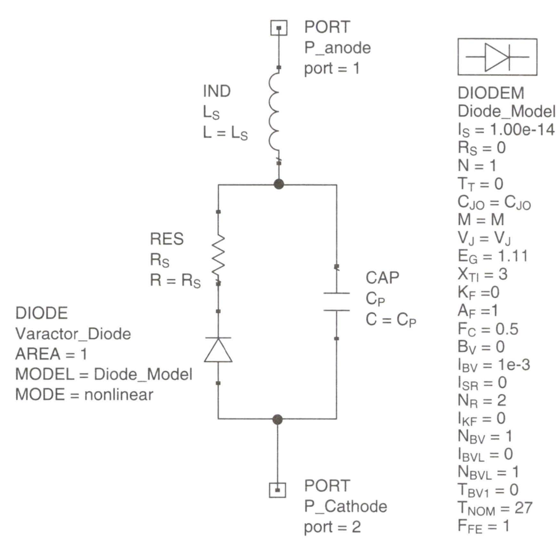
SOD-323



Capacitance vs. Reverse Voltage

V_R (V)	C_T (pF)
0	13.30
1	8.60
2	6.30
3	4.80
4	3.60
5	2.70
6	2.00
7	1.60
8	1.40
9	1.20
10	1.10
11	1.00
12	0.94
13	0.89
14	0.85
15	0.81
16	0.78
17	0.75
18	0.73
19	0.71
20	0.69

SPICE Model



Part Number	C_{J0} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1281-011	13	14	6	0.62	1.7	1.2

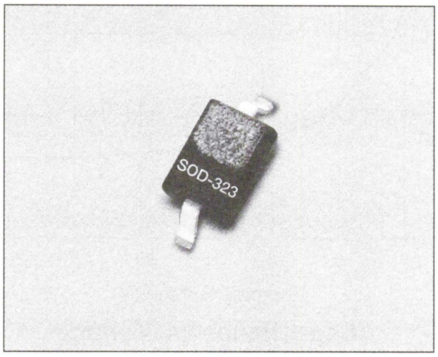
Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV1283-011

Features

- High Tuning Ratio
- SOD-323 Package
- Designed for High Volume, Low Cost Applications
- Available in Tape and Reel Packaging



Description

The SMV1283-011 is a surface mount varactor diode in the SOD-323 plastic package. It is designed for very high capacitance tuning ratio while having low series resistance, which makes this device especially attractive for wideband VCO applications.

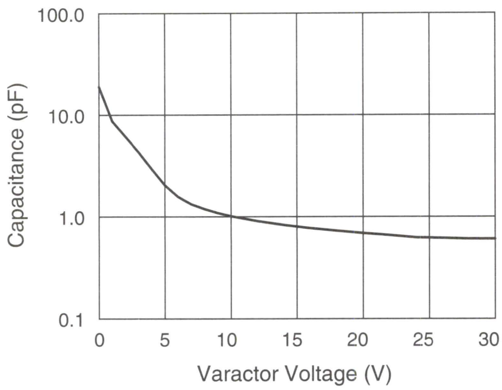
Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

Electrical Specifications at 25°C

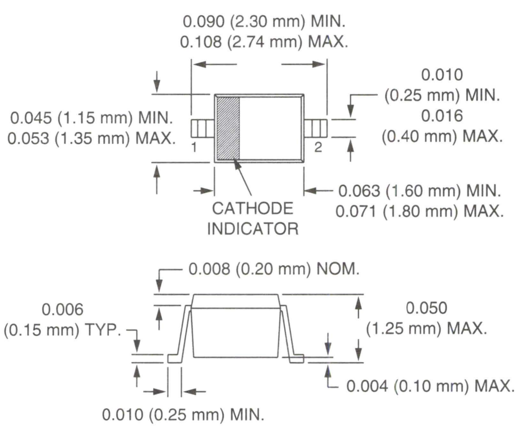
Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 26 V			20.00	nA
Capacitance (C_T)	C_T @ 1 V, V_R = 1 V, F = 1 MHz	8.5	9.10	9.70	pF
Capacitance (C_T)	C_T @ 26 V, V_R = 26 V, F = 1 MHz	0.5	0.62	0.75	pF
Capacitance Ratio (C_{TR})	C_T (1 V)/C_T (26 V)		14.70		
Series Resistance (R_S)	V_R = 1 V, F = 500 MHz		2.40		Ω
Breakdown Voltage (V_{BR})	I_R = 10 μA	28.0			V

Typical Performance Data



Capacitance vs. Voltage

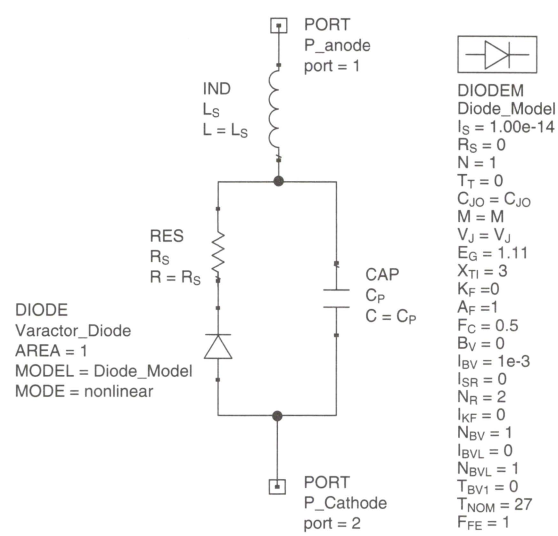
SOD-323



Capacitance vs. Voltage

V_R (V)	C_T (pF)
0	18.8820
1	8.7000
2	6.1400
3	4.3300
4	2.9500
5	2.0400
6	1.5680
7	1.3250
8	1.1880
9	1.0870
10	1.0123
12	0.9040
14	0.8295
16	0.7720
18	0.7280
20	0.6880
22	0.6580
24	0.6230
26	0.6160
28	0.6060
30	0.6040

SPICE Model



Part Number	C_{J0} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1283-011	19	3	2.6	0.58	2.4	1.7

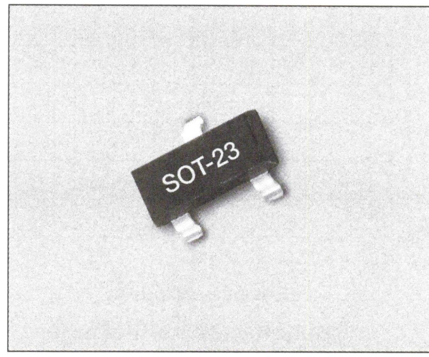
Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV2022–SMV2023

Features

- Low Series Resistance
- High Capacitance Ratio at Low Reverse Voltage
- SOT-23 Single and Common Cathode
- Designed for High Volume, Low Cost Battery Applications
- Available in Tape and Reel Packaging



Description

The SMV2022 and SMV2023 devices are silicon hyperabrupt junction varactor diodes. The specified high capacitance ratio and low R_S of these varactors make them attractive for low phase noise VCOs in wireless systems.

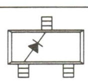
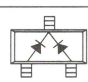
Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	22 V
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

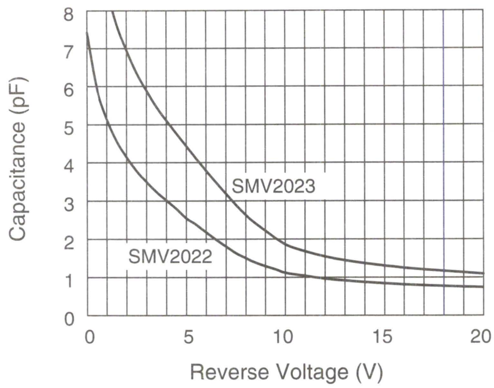
Electrical Specifications at 25°C

Part Number	C_T @ 4 V (pF)		C_T @ 20 V (pF)		$\frac{C_T\ @\ 4\ V}{C_T\ @\ 20\ V}$ (Ratio)	Q @ 4 V
	Min.	Max.	Min.	Max.	Min.	50 MHz
SMV2022	2.5	3.3	0.6	0.85	3.0	500
SMV2023	4.4	5.4	0.9	1.20	4.2	500

Reverse current I_R (V_R = 16 nA): 50 nA.

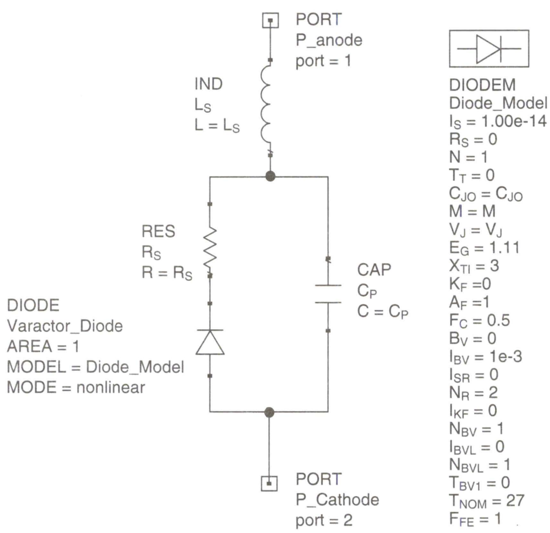
	
Single	Common Cathode
SOT-23	SOT-23
SMV2022-001	**SMV2022-004**
SMV2023-001	**SMV2023-004**
L_S = 1.5 nH	L_S = 1.5 nH

Typical Performance Data



Capacitance vs. Voltage

SPICE Model

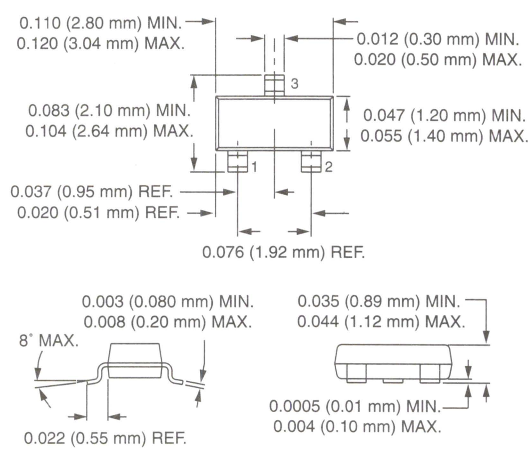


Part Number	C_{J0} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV2022	7.30	4.0	1.4	0	2.2	1.5
SMV2023	12.23	4.0	1.4	0	1.6	1.5

Capacitance vs. Voltage

V_R (V)	SMV2022 C_T (pF)	SMV2023 C_T (pF)
0.0	7.41	12.33
0.5	5.94	9.90
1.0	5.14	8.60
1.5	4.56	7.62
2.0	4.14	6.94
2.5	3.78	6.34
3.0	3.49	5.88
3.5	3.23	5.45
4.0	3.01	5.09
5.0	2.54	4.42
6.0	2.18	3.77
7.0	1.8	3.18
8.0	1.5	2.63
9.0	1.29	2.21
10.0	1.11	1.86
11.0	1.03	1.68
12.0	0.96	1.54
13.0	0.91	1.44
14.0	0.87	1.37
15.0	0.83	1.30
16.0	0.81	1.25
17.0	0.78	1.20
18.0	0.76	1.16
19.0	0.75	1.13
20.0	0.73	1.09

SOT-23



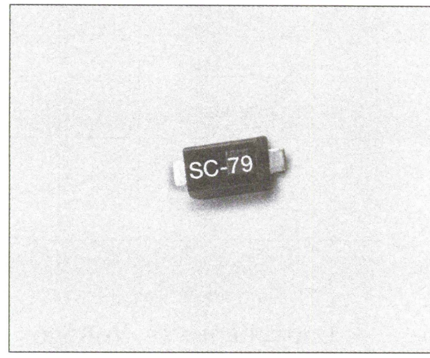
Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV1263-079

Features

- High Capacitance Ratio at Low Reverse Voltage
- Ultra Small SC-79 Package
- Designed for High Volume, Low Cost Battery Applications
- Available in Tape and Reel Packaging



Description

The SMV1263-079 is a silicon hyperabrupt junction varactor diode specifically designed for 3 V platforms. The specified high capacitance ratio and low R_S of this varactor make it attractive for low phase noise VCOs in wireless systems up to and beyond 2.5 GHz. Applications include low noise and wideband UHF and VHF VCO for GSM, PCS, CDMA and analog phones.

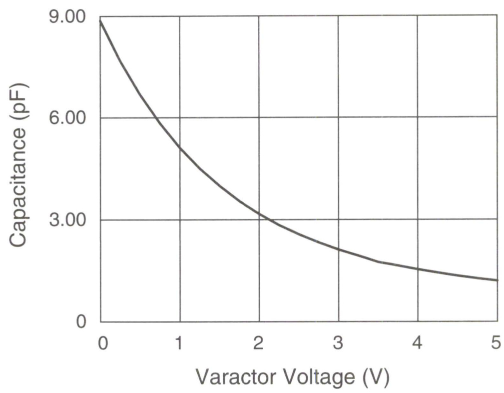
Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

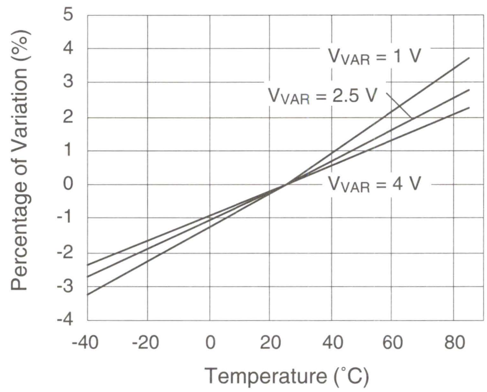
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 15 V			20.0	nA
Capacitance (C_T)	C_T @ 0.5 V, V_R = 0.5 V, F = 1 MHz	6.2	6.7	7.2	pF
Capacitance (C_T)	C_T @ 2.5 V, V_R = 2.5 V, F = 1 MHz	2.3	2.6	2.9	pF
Capacitance Ratio (C_{TR})	C_T (0.5 V)/C_T (2.5 V)	2.3	2.5		
Series Resistance (R_S)	V_R = 1 V, F = 900 MHz			1.2	Ω
Breakdown Voltage (V_{BR})	I_R = 10 µA	20.0			V

Typical Performance Data

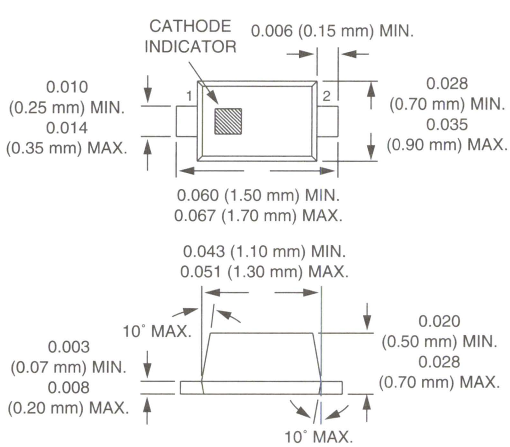


Capacitance vs. Voltage



Relative Capacitance Change vs. Temperature

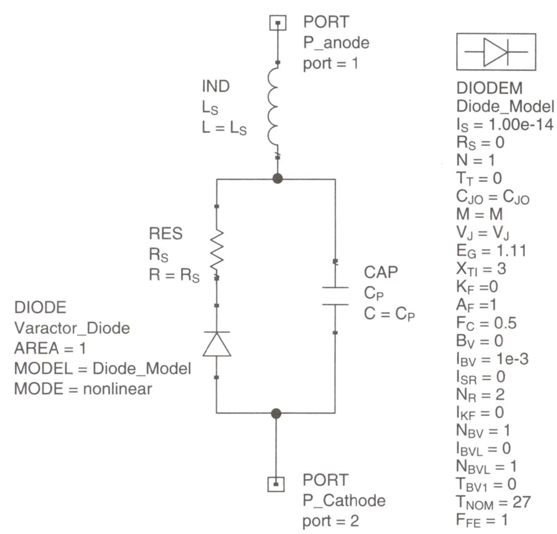
SC-79



Capacitance vs. Voltage

V_R (V)	C_T (pF)
0.00	8.87
0.25	7.68
0.50	6.68
0.75	5.83
1.00	5.11
1.25	4.50
1.50	3.99
1.75	3.54
2.00	3.17
2.25	2.84
2.50	2.57
2.75	2.33
3.00	2.12
3.25	1.94
3.50	1.79
3.75	1.65
4.00	1.54
4.25	1.44
4.50	1.35
4.75	1.27
5.00	1.20

SPICE Model



Part Number	C_{J0} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1263-079	8.2	15	9.5	0.67	1.2	1.7

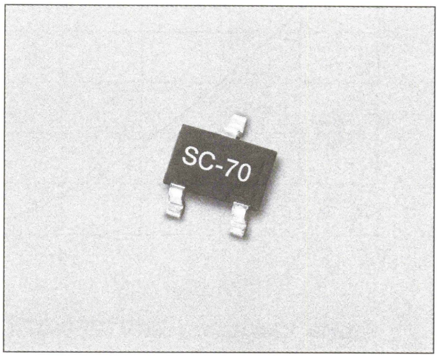
Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV1269-074

Features

- High Capacitance Ratio
- Ultra Small Size SC-70 Package
- Designed for High Volume, Low Cost Battery Applications
- Available in Tape and Reel Packaging



Description

The SMV1269-074 is a dual silicon hyperabrupt junction varactor diode in a common cathode configuration specifically designed for battery operation.The specified high capacitance ratio and low R_S of this varactor make it appropriate for low noise VCOs used at frequencies in wireless systems to beyond 2.5 GHz. Applications include low noise and wideband UHF and VHF VCO for GSM, PCS, CDMA and analog phones.

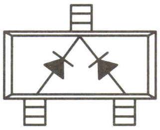
Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

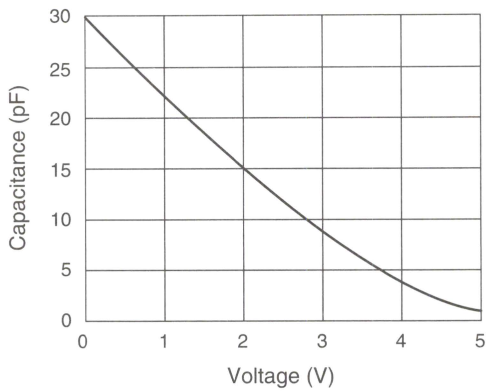
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 8 V			20.0	nA
Capacitance (C_T)	C_T @ 0.5 V, V_R = 0.5 V, F = 1 MHz	19.2	20.5	21.8	pF
Capacitance (C_T)	C_T @ 2.5 V, V_R = 2.5 V, F = 1 MHz	6.5	7.3	8.1	pF
Capacitance Ratio (C_{TR})	C_T (0.5 V)/C_T (2.5 V)	2.5	2.8		
Series Resistance (R_S)	V_R = 1 V, F = 900 MHz		0.6	0.8	Ω
Breakdown Voltage (V_{BR})	I_R = 10 μA	10.0			V

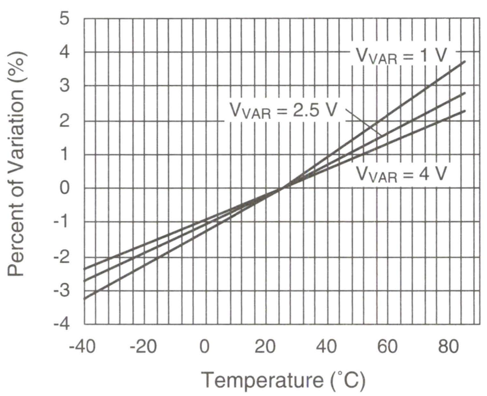
Common Cathode Configuration



Typical Performance Data

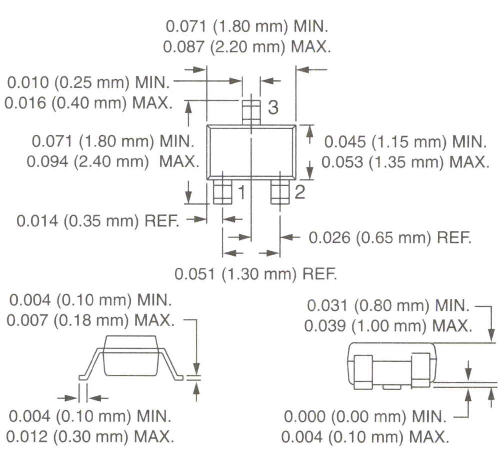


Alpha Varactor (SMV1269-074)



Relative Capacitance Change vs. Temperature

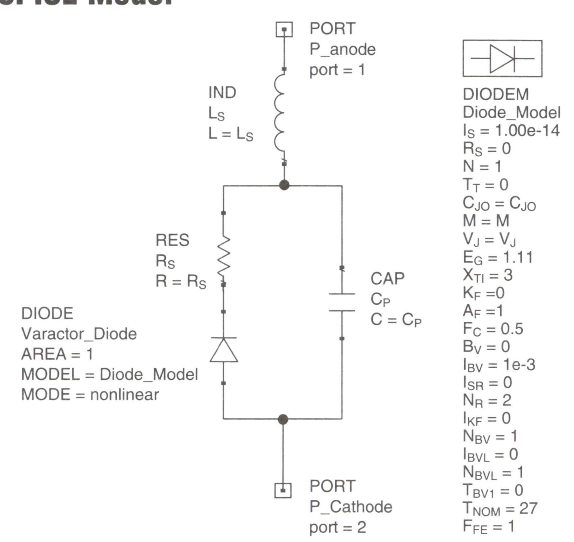
SC-70



Capacitance vs. Voltage

V_R (V)	C_T (pF)
0	29.0
0.2	25.3
0.4	22.4
0.6	20.1
0.8	18.0
1.0	16.2
1.2	14.6
1.4	13.2
1.6	11.9
1.8	10.7
2.0	9.6
2.2	8.7
2.4	7.8
2.6	7.0
2.8	6.3
3.0	5.7
3.2	5.2
3.4	4.8
3.6	4.4
3.8	4.1
4.0	3.9
4.2	3.7
4.4	3.5
4.6	3.3
4.8	3.2
5.0	3.1

SPICE Model



Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1269-074	28.5	6.3	4.2	0.5	0.6	1.4

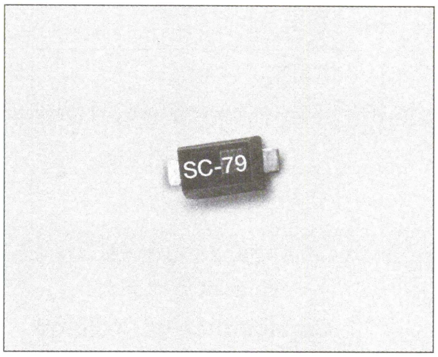
Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV1270-079

Features

- High Capacitance Ratio
- Ultra Small Size SC-79 Package
- Designed for High Volume, Low Cost Battery Applications
- Available in Tape and Reel Packaging



Description

The SMV1270-079 is a silicon hyperabrupt junction varactor diode specifically designed for battery operation. The specified high capacitance ratio and low R_S of this varactor make it appropriate for low noise VCOs used at frequencies in wireless systems to beyond 2.5 GHz. Applications include low noise and wideband UHF and VHF VCO for GSM, PCS, CDMA and analog phones.

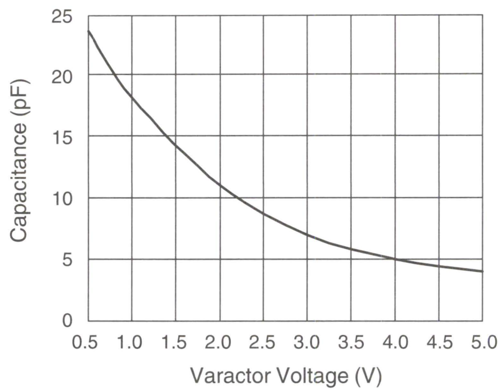
Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

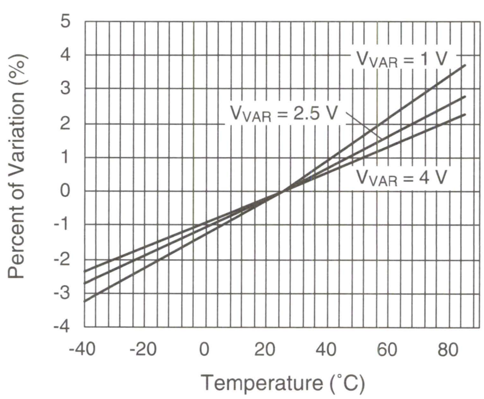
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 20 V			20.0	nA
Capacitance (C_T)	C_T @ 0.5 V, V_R = 0.5 V, F = 1 MHz	22.1	23.6	25.1	pF
Capacitance (C_T)	C_T @ 2.5 V, V_R = 2.5 V, F = 1 MHz	7.7	8.6	9.8	pF
Capacitance Ratio (C_{TR})	C_T (0.5 V)/C_T (2.5 V)	2.3	2.7		
Series Resistance (R_S)	V_R = 1 V, F = 470 MHz		0.7		Ω
Breakdown Voltage (V_{BR})	I_R = 10 µA	20.0			V

Typical Performance Data



Capacitance vs. Voltage

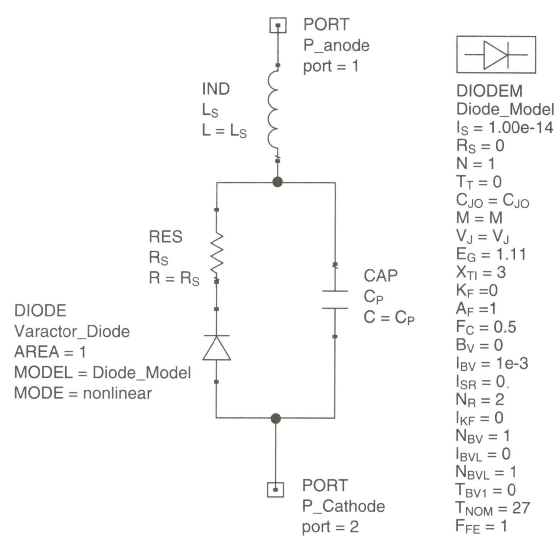


Relative Capacitance Change vs. Temperature

Capacitance vs. Voltage

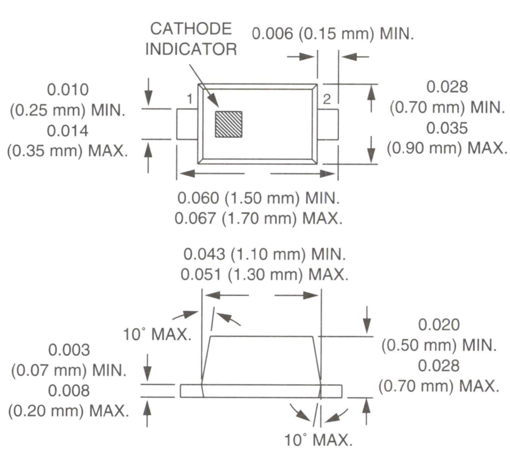
V_R (V)	C_T (pF)
0.5	23.64
1.0	17.81
1.5	13.69
2.0	10.74
2.5	8.60
3.0	7.03
3.5	5.87
4.0	5.00
4.5	4.35
5.0	3.85

SPICE Model



Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1270-079	30	12	8	2	0.7	1.7

SC-79



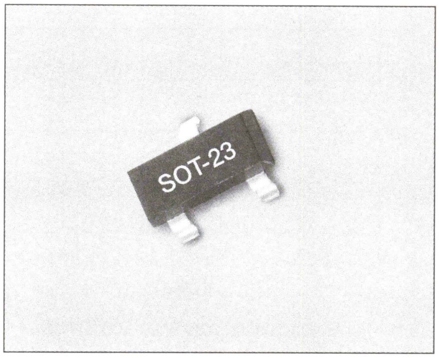
Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV1470-004

Features

- High Capacitance Ratio
- Designed for High Volume
- Available in Tape and Reel Packaging



Description

The SMV1470-004 is a dual silicon hyperabrupt junction varactor diode in a common cathode configuration. The specified high capacitance ratio and low R_S of this varactor make it appropriate for low noise VCOs and VCXOs in wireless systems. Applications include low noise and wideband VCO and VCXO for GSM, PCS, CDMA and analog phones.

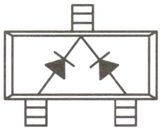
Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

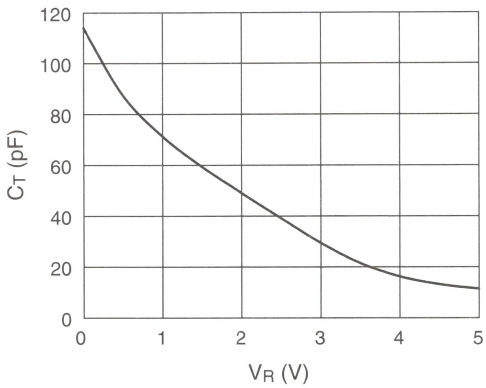
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 10 V			20.0	nA
Capacitance (C_T)	V_R = 1 V, F = 1 MHz	65.8	70.0	74.2	pF
Capacitance (C_T)	V_R = 4.5 V, F = 1 MHz	12.0	13.4	14.8	pF
Capacitance Ratio (C_{TR})	C_T (1 V)/C_T (5 V)	5.0	6.0		
Series Resistance (R_S)	V_R = 1.5 V, F = 900 MHz		0.5	0.8	Ω
Breakdown Voltage (V_{BR})	I_R = 10 µA	10.0			V

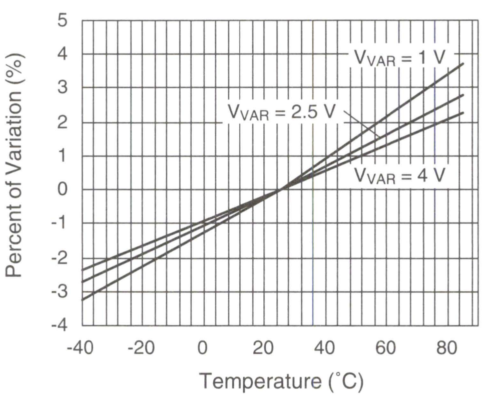
Common Cathode Configuration



Typical Performance Data

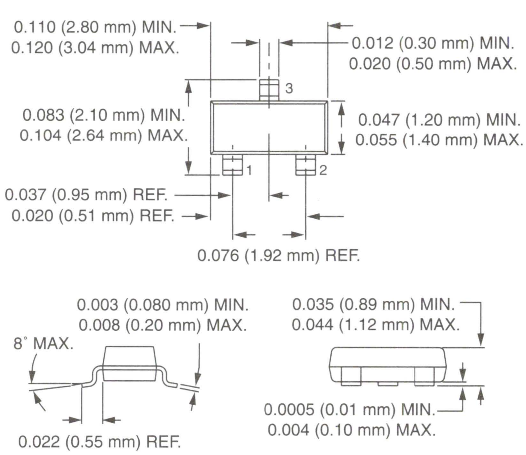


Capacitance vs. Voltage



Relative Capacitance Change vs. Temperature

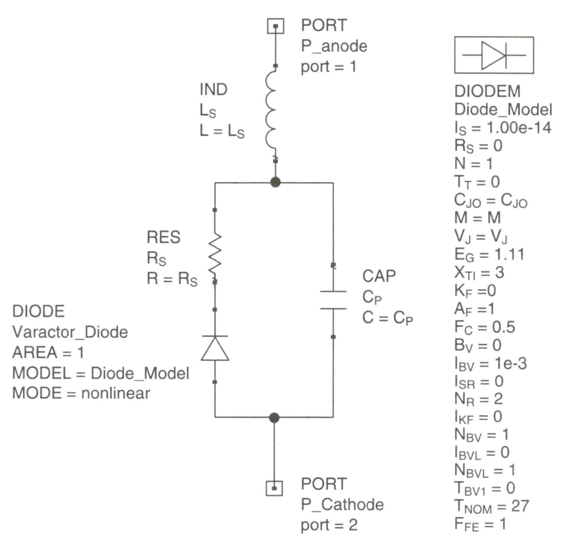
SOT-23



Capacitance vs. Voltage

V_R (V)	C_T (pF)
0.0	113.9
0.5	87.4
1.0	71.3
1.5	59.3
2.0	49.0
2.5	39.1
3.0	29.4
3.5	21.4
4.0	16.3
4.5	13.3
5.0	11.5
5.5	10.3
6.0	9.5
6.5	8.9
7.0	8.5
7.5	8.1
8.0	7.9
8.5	7.7
9.0	7.6
9.5	7.5
10.0	7.5

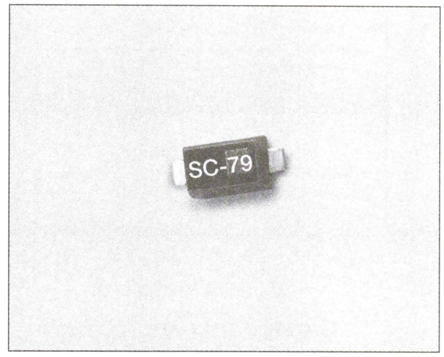
SPICE Model



Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1470-004	113	25	13	1	0.5	1.4

Features

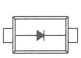
- Designed for High Volume, Low Cost Battery Applications
- Low Series Resistance
- High Capacitance Ratio
- Available Lead (Pb)-Free MSL-1 @ 250°C per JEDEC J-STD-020
- Ultra Small Size SC-79 Package
- Available in Tape and Reel Packaging



Description

The SMV1705 series are silicon hyperabrupt junction varactor diodes specifically designed for battery operation. The specified high capacitance ratio and low R_S of these varactors make them appropriate for low noise VCOs used at frequencies in wireless systems to beyond 2.5 GHz. Applications include low noise and wideband UHF and VHF VCO for GSM, PCS, CDMA and analog phones.

NEW Lead (Pb)-Free "environmentally friendly" packaging available: Skyworks offers the SMV1705-079LF Lead (Pb)-Free package as a green alternative.


Single
SC-79
SMV1705-079
SMV1705-079LF
L_S = 0.7 nH

LF denotes Lead (Pb)-Free packaging.

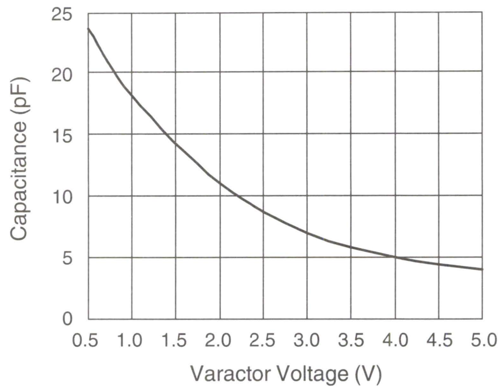
Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

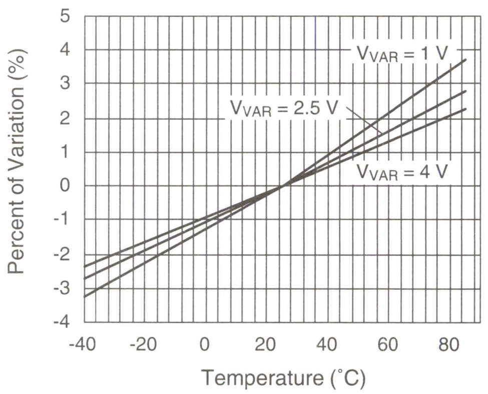
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 8 V		< 0.01	20.0	nA
Capacitance (C_T)	V_R = 1 V, F = 1 MHz	17.3	18.30	19.3	pF
Capacitance (C_T)	V_R = 4 V, F = 1 MHz	5.3	6.10	6.6	pF
Capacitance Ratio (C_{TR})	C_T (1 V)/C_T (4 V)	2.8	3.00		
Series Resistance (R_S)	V_R = 1 V, F = 470 MHz		0.32		Ω
Breakdown Voltage (V_{BR})	I_R = 10 µA	12.0			V

Typical Performance Data

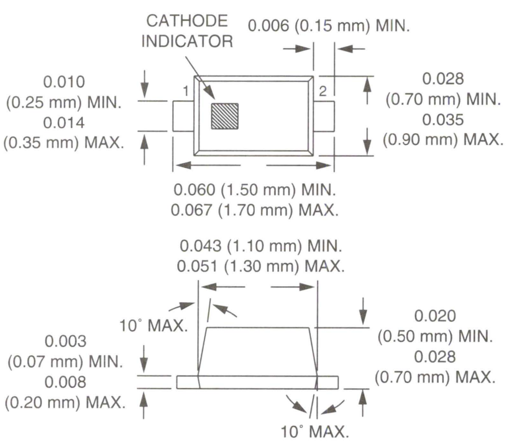


Capacitance vs. Voltage



Relative Capacitance Change vs. Temperature

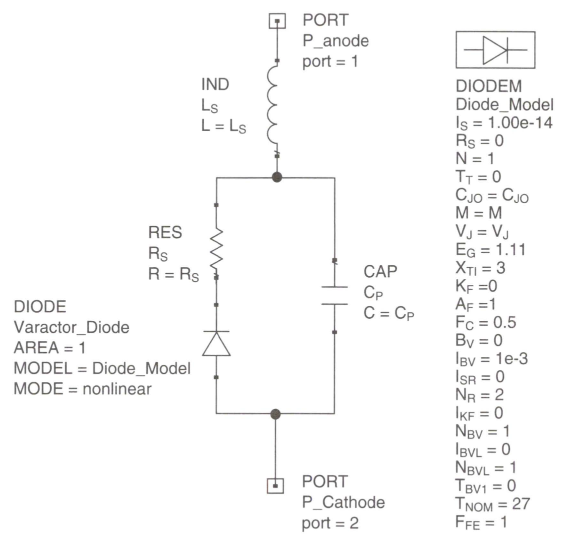
SC-79



Capacitance vs. Voltage

V_R (V)	C_T (pF)
0.0	31.5
0.5	23.5
1.0	18.3
1.5	14.3
2.0	11.9
2.5	9.7
3.0	8.3
3.5	7.1
4.0	6.1
4.5	5.5
5.0	5.2

SPICE Model

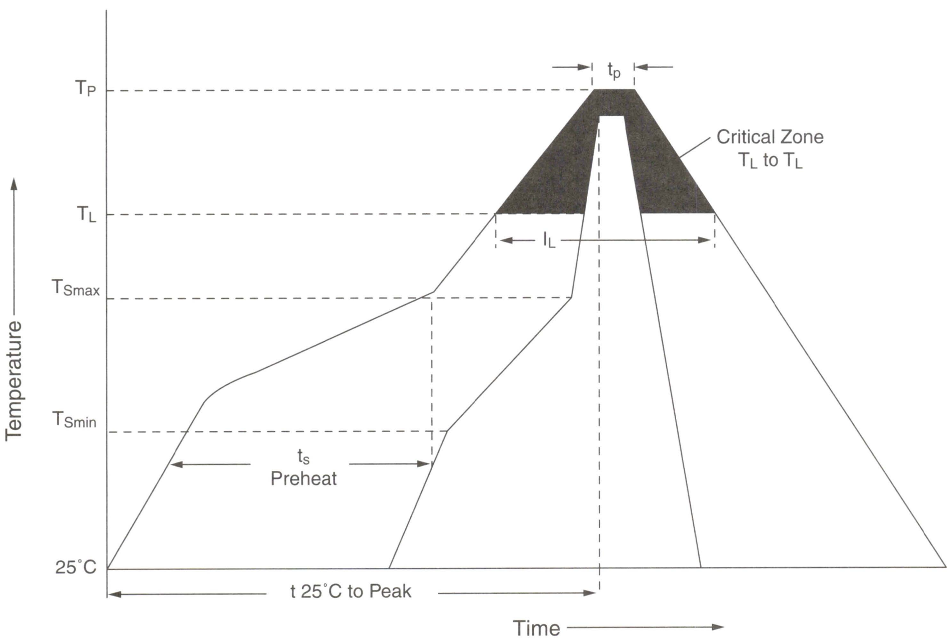


Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1705	31	3	2	0.5	0.32	0.8

Recommended Solder Reflow Profiles

Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average Ramp-Up Rate (T_L to T_P)	3°C/Second Max.	3°C/Second Max.
Preheat Temperature Min. (T_{Smin}) Temperature Max. (T_{Smax}) Time (Min. to Max.) (ts)	 100°C 150°C 60–120 Seconds	 150°C 200°C 60–80 Seconds
T_{Smax} to T_L Ramp-up Rate	—	3°C/Second Max.
Time Maintained Above: Temperature (T_L) Time (t_L)	 183°C 60–150 Seconds	 217°C 60–150 Seconds
Peak Temperature (T_P)	240 +0/-5°C	250 +0/-5°C
Time Within 5°C of Actual Peak Temperature (tp)	10–30 Seconds	20–40 Seconds
Ramp-Down Rate	6°C/Second Max.	6°C/Second Max.
Time 25°C to Peak Temperature	6 Minutes Max.	8 Minutes Max.

All temperatures refer to the topside of the package, measured on the package body surface.
Reference JEDEC J-STD-020B.

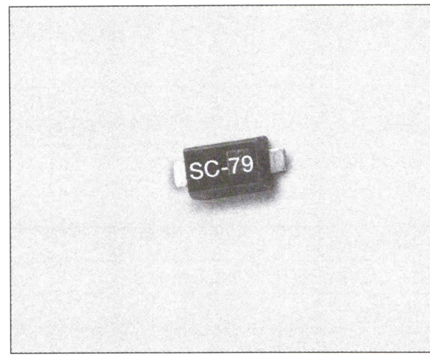


Reference JEDEC J-STD-020

Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV1763 Series



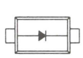
Features

- Designed for High Volume, Low Cost Battery Applications
- Low Series Resistance
- High Capacitance Ratio at Low Reverse Voltage
- Available Lead (Pb)-Free MSL-1 @ 250°C per JEDEC J-STD-020
- Ultra Small SC-79 Package
- Available in Tape and Reel Packaging

Description

The SMV1763 series is a silicon hyperabrupt junction varactor diode specifically designed for 3 V platforms. The specified high capacitance ratio and low R_S of this varactor make it attractive for low phase noise VCOs in wireless systems up to and beyond 2.5 GHz. Applications include low noise and wideband UHF and VHF VCO for GSM, PCS, CDMA and analog phones.

NEW Lead (Pb)-Free "environmentally friendly" packaging available: Skyworks offers the SMV1763-079LF Lead (Pb)-Free package as a green alternative.



Single
SC-79
SMV1763-079
SMV1763-079LF
L_S = 0.7 nH

LF denotes Lead (Pb)-Free packaging.

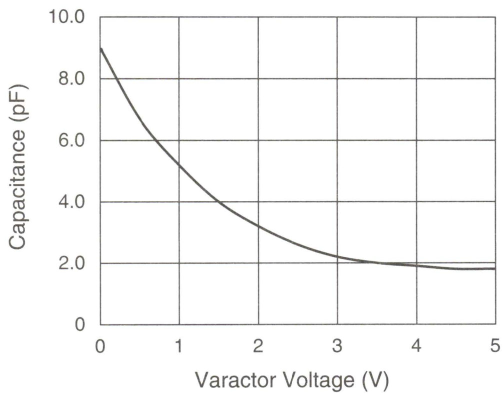
Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

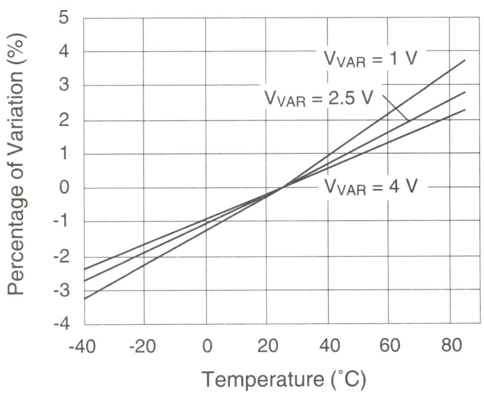
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 8 V			20.0	nA
Capacitance (C_T)	C_T @ 0.5 V, V_R = 0.5 V, F = 1 MHz	6.2	6.7	7.2	pF
Capacitance (C_T)	C_T @ 2.5 V, V_R = 2.5 V, F = 1 MHz	2.3	2.6	2.9	pF
Capacitance Ratio (C_{TR})	C_T (0.5 V)/C_T (2.5 V)	2.3	2.5		
Series Resistance (R_S)	V_R = 1 V, F = 900 MHz		0.5	0.7	Ω
Breakdown Voltage (V_{BR})	I_R = 10 μA	10.0			V

Typical Performance Data

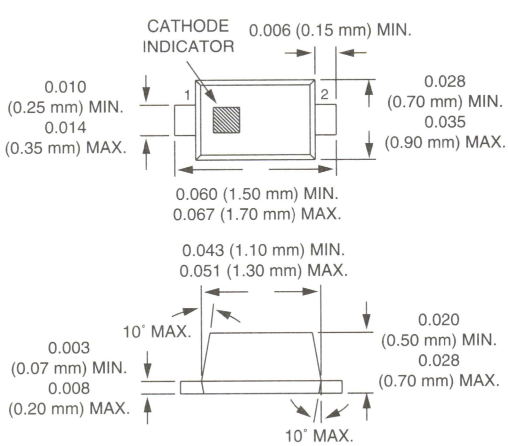


Capacitance vs. Voltage



Relative Capacitance Change vs. Temperature

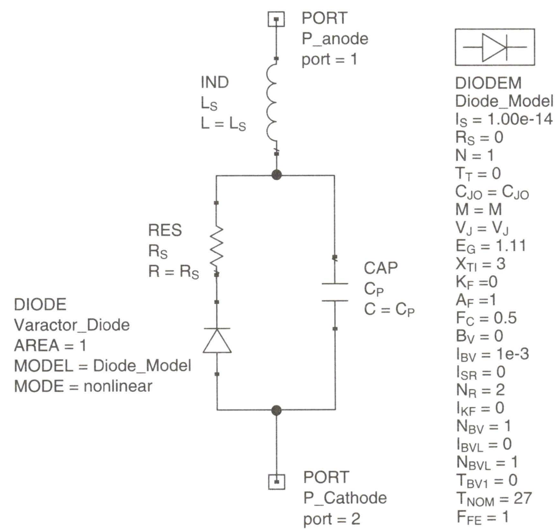
SC-79



Capacitance vs. Voltage

V_R (V)	C_T (pF)
0.0	9.0
0.5	6.7
1.0	5.2
1.5	4.0
2.0	3.2
2.5	2.6
3.0	2.2
3.5	2.0
4.0	1.9
4.5	1.8
5.0	1.8

SPICE Model

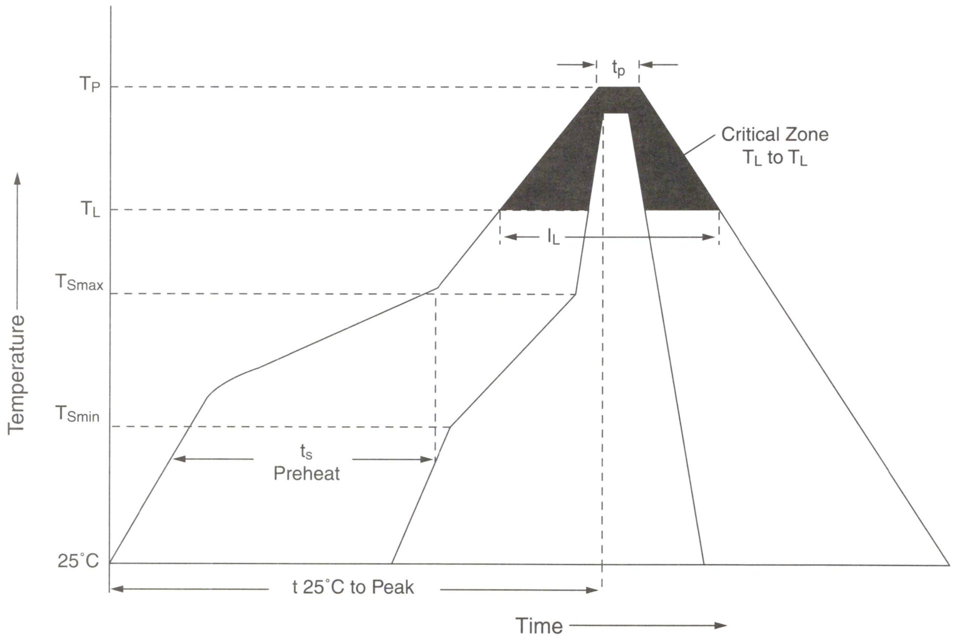


Part Number	C_{J0} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1763	8.2	15	9.5	0.67	0.5	0.8

Recommended Solder Reflow Profiles

Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average Ramp-Up Rate (T_L to T_P)	3°C/Second Max.	3°C/Second Max.
Preheat Temperature Min. (T_{Smin}) Temperature Max. (T_{Smax}) Time (Min. to Max.) (ts)	 100°C 150°C 60–120 Seconds	 150°C 200°C 60–80 Seconds
T_{Smax} to T_L Ramp-up Rate	—	3°C/Second Max.
Time Maintained Above: Temperature (T_L) Time (t_L)	 183°C 60–150 Seconds	 217°C 60–150 Seconds
Peak Temperature (T_P)	240 +0/-5°C	250 +0/-5°C
Time Within 5°C of Actual Peak Temperature (tp)	10–30 Seconds	20–40 Seconds
Ramp-Down Rate	6°C/Second Max.	6°C/Second Max.
Time 25°C to Peak Temperature	6 Minutes Max.	8 Minutes Max.

All temperatures refer to the topside of the package, measured on the package body surface.
Reference JEDEC J-STD-020B.



Reference JEDEC J-STD-020

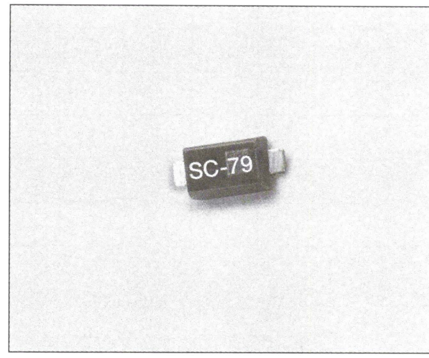
Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV1770 Series

Features

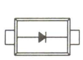
- Designed for High Volume, Low Cost Battery Applications
- Low Series Resistance
- High Capacitance Ratio
- Available Lead (Pb)-Free MSL-1 @ 250°C per JEDEC J-STD-020
- Ultra Small Size SC-79 Package
- Available in Tape and Reel Packaging



Description

The SMV1770 series is a silicon hyperabrupt junction varactor diode specifically designed for battery operation. The specified high capacitance ratio and low R_S of this varactor make it appropriate for low noise VCOs used at frequencies in wireless systems to beyond 2.5 GHz. Applications include low noise and wideband UHF and VHF VCO for GSM, PCS, CDMA and analog phones.

NEW Lead (Pb)-Free "environmentally friendly" packaging available: Skyworks offers the SMV1770-079LF Lead (Pb)-Free package as a green alternative.


Single
SC-79
SMV1770-079
SMV1770-079LF
L_S = 0.7 nH

LF denotes Lead (Pb)-Free packaging.

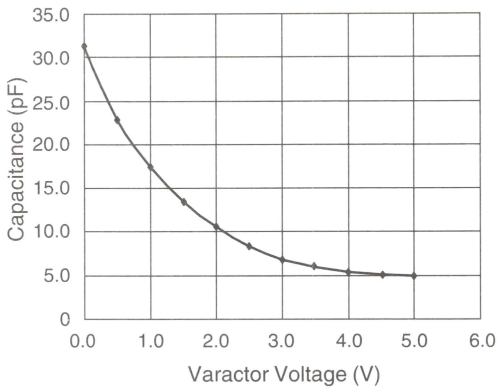
Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

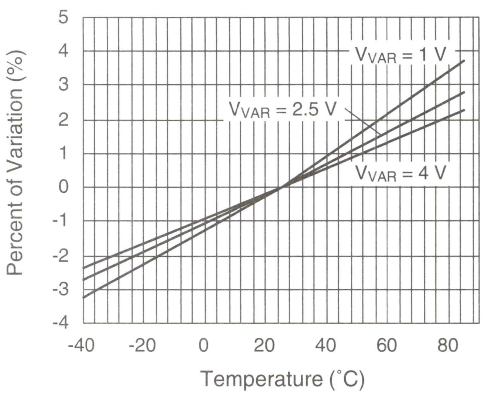
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 8 V			20.0	nA
Capacitance (C_T)	C_T @ 0.5 V, V_R = 0.5 V, F = 1 MHz	22.1	23.6	25.1	pF
Capacitance (C_T)	C_T @ 2.5 V, V_R = 2.5 V, F = 1 MHz	7.7	8.6	9.8	pF
Capacitance Ratio (C_{TR})	C_T (0.5 V)/C_T (2.5 V)	2.3	2.7		
Series Resistance (R_S)	V_R = 1 V, F = 470 MHz		0.4	0.5	Ω
Breakdown Voltage (V_{BR})	I_R = 10 µA	12.0			V

Typical Performance Data

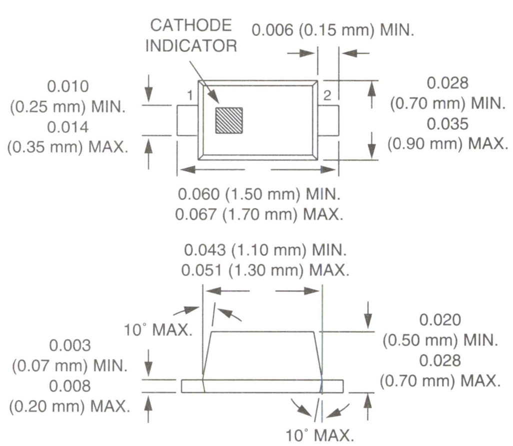


Capacitance vs. Voltage



Relative Capacitance Change vs. Temperature

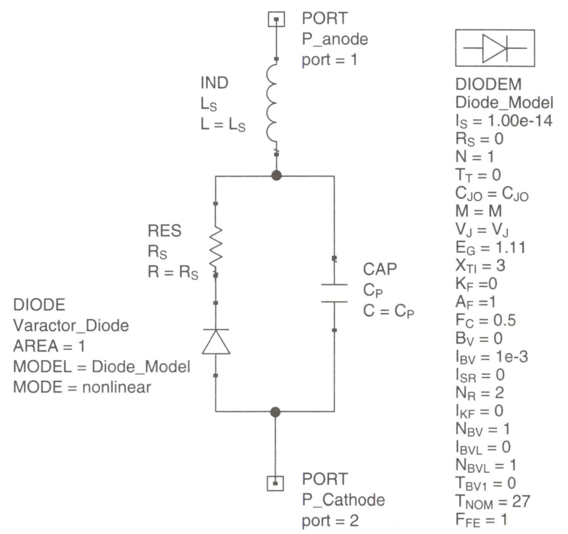
SC-79



Capacitance vs. Voltage

V_R (V)	C_T (pF)
0.0	31.2
0.5	23.6
1.0	17.8
1.5	13.7
2.0	10.7
2.5	8.6
3.0	7.0
3.5	5.9
4.0	5.5
4.5	5.2
5.0	5.0

SPICE Model

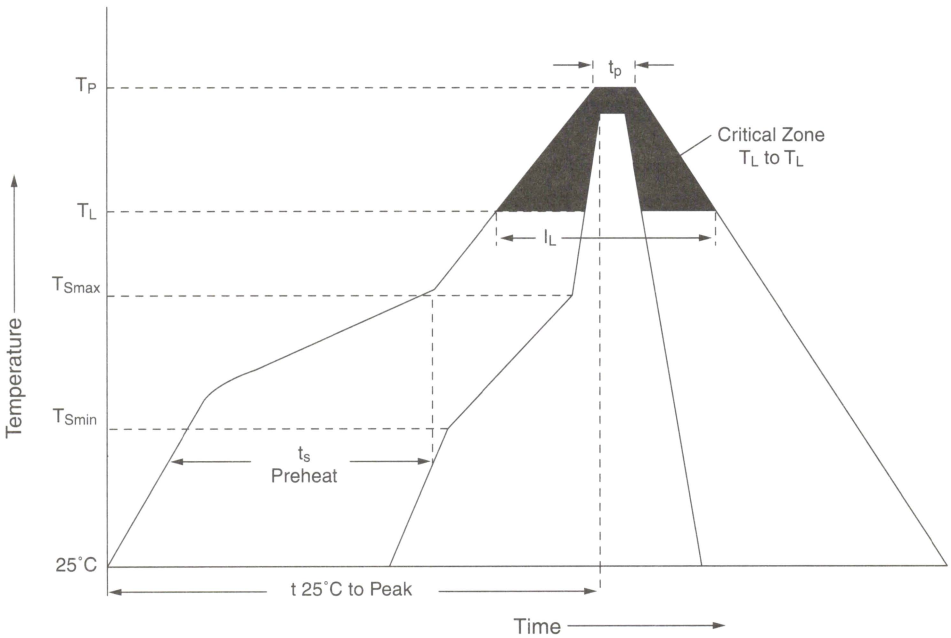


Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1770	31	12	8	2	0.4	0.8

Recommended Solder Reflow Profiles

Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average Ramp-Up Rate (T_L to T_P)	3°C/Second Max.	3°C/Second Max.
Preheat Temperature Min. (T_{Smin}) Temperature Max. (T_{Smax}) Time (Min. to Max.) (ts)	 100°C 150°C 60–120 Seconds	 150°C 200°C 60–80 Seconds
T_{Smax} to T_L Ramp-up Rate	—	3°C/Second Max.
Time Maintained Above: Temperature (T_L) Time (t_L)	 183°C 60–150 Seconds	 217°C 60–150 Seconds
Peak Temperature (T_P)	240 +0/-5°C	250 +0/-5°C
Time Within 5°C of Actual Peak Temperature (tp)	10–30 Seconds	20–40 Seconds
Ramp-Down Rate	6°C/Second Max.	6°C/Second Max.
Time 25°C to Peak Temperature	6 Minutes Max.	8 Minutes Max.

All temperatures refer to the topside of the package, measured on the package body surface.
Reference JEDEC J-STD-020B.



Reference JEDEC J-STD-020

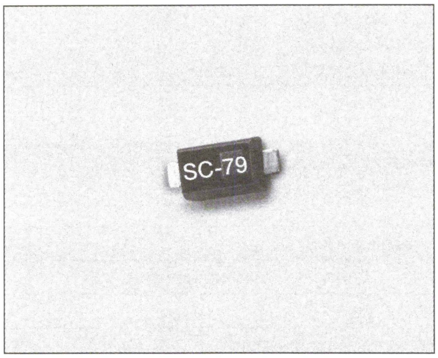
Hyperabrupt Junction Tuning Varactor

SKYWORKS

SMV1771-079

Features

- Low Series Resistance
- High Capacitance Ratio
- Ultra Small Size SC-79 Package
- Designed for High Volume, Low Cost Battery Applications
- Available in Tape and Reel Packaging



Description

The SMV1771-079 is a silicon hyperabrupt junction varactor diode specifically designed for battery operation.The specified high capacitance ratio and low R_S of this varactor make it appropriate for low noise VCOs used at frequencies in wireless systems to beyond 2.5 GHz. Applications include low noise and wideband UHF and VHF VCO for GSM, PCS, CDMA and analog phones.

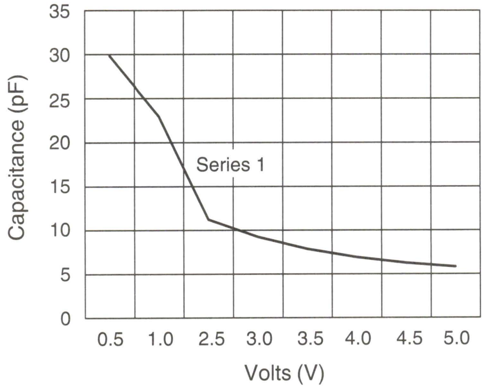
Absolute Maximum Ratings

Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 8 V			20.0	nA
Capacitance (C_T)	V_R = 1 V, F = 1 MHz	22.0		24.0	pF
Capacitance (C_T)	V_R = 2.5 V, F = 1 MHz	9.5		12.5	pF
Capacitance Ratio (C_{TR})	C_T (0.5 V)/C_T (2.5 V)	2.3	2.7		
Series Resistance (R_S)	V_R = 1 V, F = 470 MHz		0.4	0.5	Ω
Breakdown Voltage (V_{BR})	I_R = 10 µA	12.0			V

Typical Performance Data

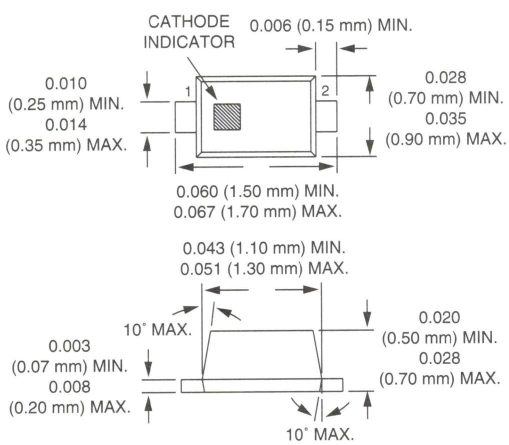


Capacitance MEAN Test Data

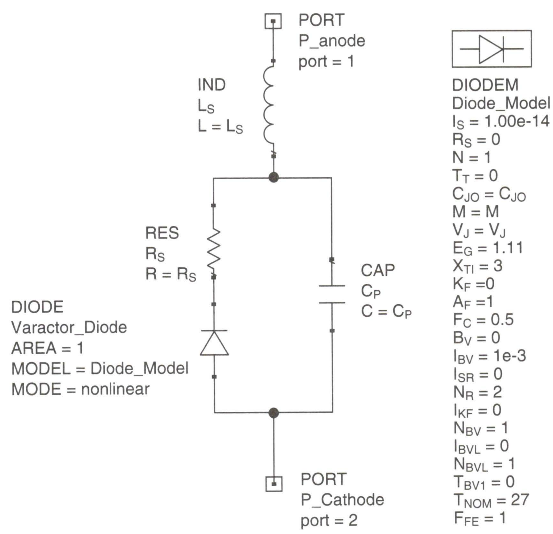
Capacitance vs. Voltage

V_R (V)	C_T (pF)
0.5	29.8
1.0	22.9
2.0	14.07
2.5	11.23
3.0	9.23
3.5	7.86
4.0	6.90
4.5	6.25
5.0	5.80

SC-79



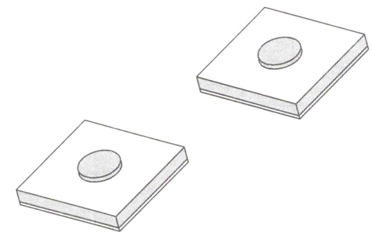
SPICE Model



Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)	L_S (nH)
SMV1771-079	31	12	8	2	0.4	0.8

Silicon Hyperabrupt Varactor Diode Chips

SMV2019 to SMV2023



Features

- High Q for Low Loss Resonators
- Low Leakage Current
- High Tuning Ratio for Wideband VCOs
- SPICE Model Parameters
- Small Footprint Chip Design

Description

Skyworks' product line of silicon hyperabrupt junction varactor diode chips are processed using established ion-implantation technology resulting in low R_S wide tuning ratio devices with high Q values. These planar chips have a small outline size (12 x 12 mils nominal) and are fully passivated resulting in low leakage current and high reliability. These varactor chips are intended for assembly in hybrid integrated circuit resonators used in VCOs and analog tuned filters.

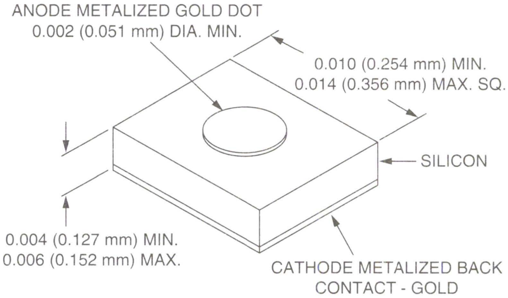
Electrical Specifications at 25°C

Part Number	C_J @ 0 V (pF)[1]	C_J @ 4 V (pF)		C_J @ 20 V (pF)		Q @ 4 V 50 MHz[2]	1 GHz R_S @ 4 V (Ω)	I_R @17.6 V (nA)[3]	Contact Diam. (mils)[4]
	Typ.	Min.	Max.	Min.	Max.	Min.	Typ.	Max.	Nom.
SMV2019-000	2.3	0.68	0.88	0.13	0.23	500	4.8	50	2.00
SMV2020-000	3.1	1.13	1.43	0.23	0.33	500	4.1	50	2.50
SMV2021-000	4.5	1.58	1.98	0.32	0.44	500	2.8	50	3.00
SMV2022-000	7.1	2.48	3.08	0.48	0.68	400	2.2	50	3.75
SMV2023-000	10.8	4.28	5.28	0.78	1.08	400	1.4	50	5.00

1. All capacitance values specified at 1 MHz.
2. 50 MHz Q calculated from 1 GHz R_S and 1 MHz C_J.
3. V_B at 10 μA specified at 22 V Min.
4. Outline drawing 149-801.

Outline Drawing

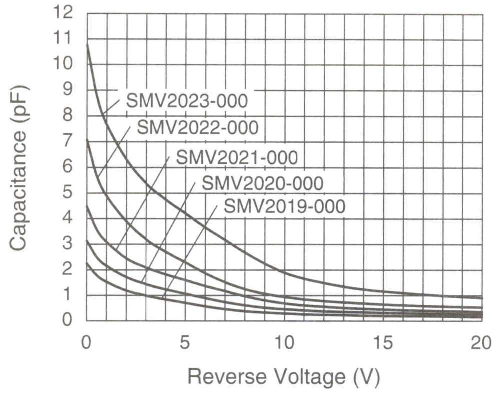
149-801



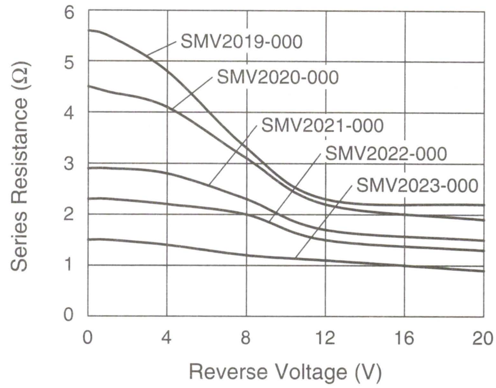
Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	22 V
Forward Current (I_F)	100 mA
Power Dissipation at 25°C (P_D)	250 mW
Operating Temperature (T_{OP})	-55°C to +150°C
Storage Temperature (T_{ST})	-65°C to +200°C

Typical Performance Data



Capacitance vs. Reverse Voltage

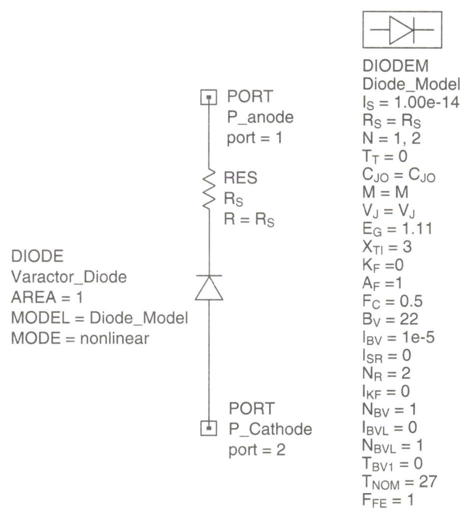


Series Resistance vs. Voltage @ 1 GHz

Typical Capacitance Values

V_R (V)	SMV2019 C_J (pF)	SMV2020 C_J (pF)	SMV2021 C_J (pF)	SMV2022 C_J (pF)	SMV2023 C_J (pF)
0.0	2.25	3.14	4.48	7.08	10.76
0.5	1.79	2.5	3.57	5.66	8.76
1.0	1.53	2.16	3.09	4.88	7.67
2.0	1.19	1.72	2.45	3.89	6.31
3.0	0.99	1.44	2.09	3.19	5.38
4.0	0.84	1.24	1.83	2.71	4.75
5.0	0.71	1.07	1.60	2.30	4.21
6.0	0.57	0.90	1.37	1.87	3.66
7.0	0.46	0.74	1.17	1.52	3.17
8.0	0.38	0.61	0.97	1.25	2.68
9.0	0.33	0.52	0.81	1.07	2.25
10.0	0.29	0.46	0.69	0.94	1.89
11.0	0.26	0.42	0.61	0.85	1.66
12.0	0.24	0.38	0.56	0.78	1.49
13.0	0.23	0.36	0.51	0.73	1.35
14.0	0.21	0.34	0.48	0.69	1.24
15.0	0.20	0.32	0.45	0.65	1.16
16.0	0.19	0.31	0.43	0.62	1.10
17.0	0.19	0.29	0.41	0.59	1.04
18.0	0.18	0.28	0.39	0.57	0.99
19.0	0.17	0.27	0.38	0.55	0.95
20.0	0.16	0.26	0.36	0.54	0.91

SPICE Model



$$C_V = \frac{C_{J0}}{\left(1 + \frac{V_R}{V_J}\right)^M} + C_P$$

Part Number	C_{JO} (pF)	V_J (V)	M	R_S (Ω)
SMV2019	2.3	3.5	1.40	4.8
SMV2020	3.3	3.6	1.30	4.1
SMV2021	4.5	3.9	1.34	2.8
SMV2022	7.1	4.0	1.40	2.2
SMV2023	10.8	4.6	1.45	1.4

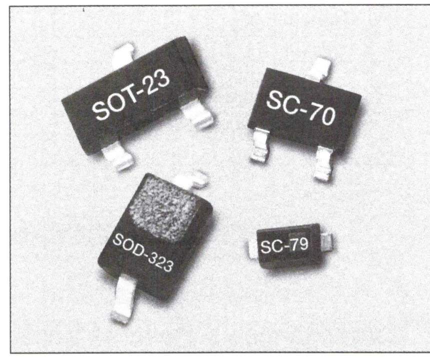
SPICE model parameters extracted from measured characteristics may not reflect exact physical or electronic properties. See application note APN1004.

SKYWORKS

SMV1405–SMV1419

Features

- High Q
- Low Series Resistance for Low Phase Noise
- Multiple Packages SOT-23, SOD-323, SC-70 and SC-79
- Designed for High Volume Commercial Applications
- SPICE Models are Available

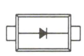
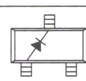
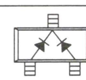
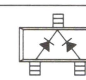


Description

The SMV1405–SMV1419 series of silicon abrupt junction varactor diodes are designed for use in VCOs requiring tight capacitance tolerances. The low resistance of these varactors makes them appropriate for high Q resonators in wireless system VCOs to frequencies beyond 2.5 GHz. The devices are characterized for capacitance over temperature. SPICE models are provided.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	30 V
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

			
Single	Single	Common Cathode	Common Cathode
SC-79	SOT-23	SOT-23	SC-70
♦ **SMV1405-079**	♦ **SMV1405-001**		♦ **SMV1405-074**
	♦ **SMV1408-001**		
	♦ **SMV1413-001**		
	♦ **SMV1417-001**	♦ **SMV1417-004**	
	♦ **SMV1419-001**		
L_S = 0.7 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.4 nH

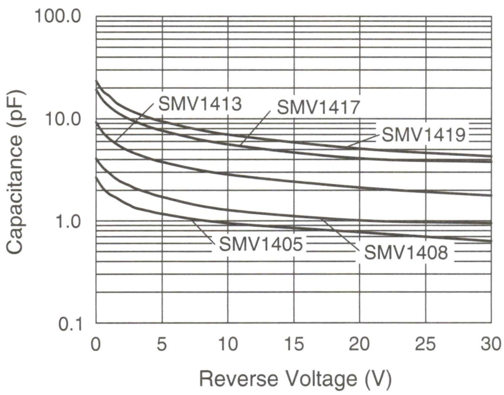
♦ Available through distribution.
For other packages or configurations, please contact the factory.

Electrical Specifications at 25°C

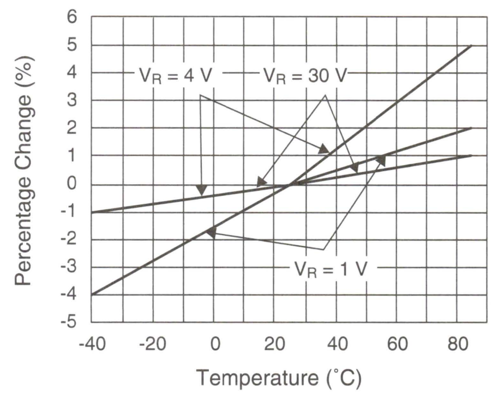
Part Number	C_T @ 0.5 V (pF)	C_T @ 1 V (pF)	C_T @ 4 V (pF)		C_T @ 0 V / C_T @ 30 V (Ratio)	R_S @ 4 V 500 MHz (Ω)	Q @ 4 V 50 MHz
	Typ.	Typ.	Min.	Max.	Min.	Max.	Typ.
SMV1405	2.1	1.8	1.21	1.45	4.1	0.80	3200
SMV1408	3.4	2.9	1.75	2.11	4.1	0.60	2900
SMV1413	7.4	6.4	3.64	4.42	4.2	0.35	2400
SMV1417	15.3	13.2	7.51	9.15	4.3	0.22	1800
SMV1419	18.7	16.6	9.13	11.13	4.4	0.20	1600

Reverse Voltage V_R (I_R = 10 μA): 30 V
Reverse Current I_R (V_R = 24 V): 20 nA

Typical Performance Data



Capacitance vs. Reverse Voltage

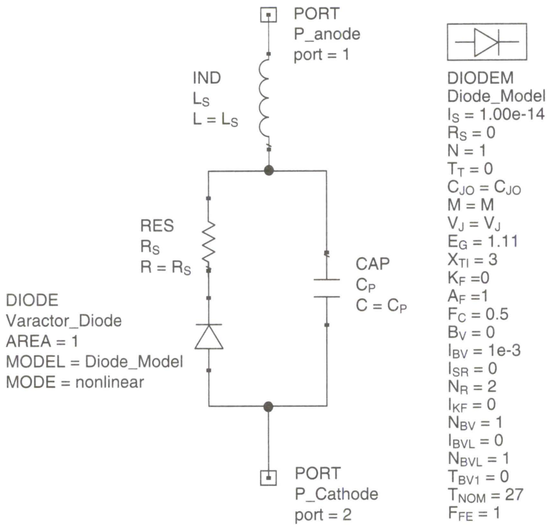


Relative Capacitance Change vs. Temperature

Typical Capacitance Values

	SMV1405	SMV1408	SMV1413	SMV1417	SMV1419
V_R (V)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)	C_T (pF)
0.0	2.67	4.08	9.24	19.20	23.44
0.5	2.12	3.36	7.39	15.30	18.72
1.0	1.84	2.94	6.37	13.16	16.64
1.5	1.70	2.60	5.71	11.76	14.38
2.0	1.55	2.38	5.22	10.74	13.14
2.5	1.44	2.24	4.85	9.95	12.18
3.0	1.34	2.08	4.55	9.32	11.42
4.0	1.25	1.88	4.10	8.35	10.26
5.0	1.17	1.72	3.77	7.64	9.40
10.0	0.95	1.28	2.85	5.62	7.00
20.0	0.77	1.01	2.12	4.09	5.10
30.0	0.63	0.95	1.77	3.79	4.30

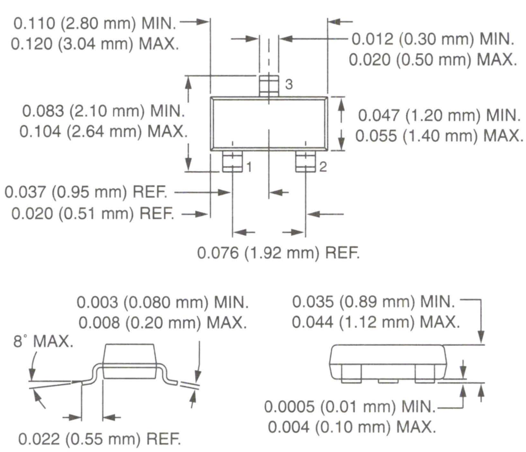
SPICE Model



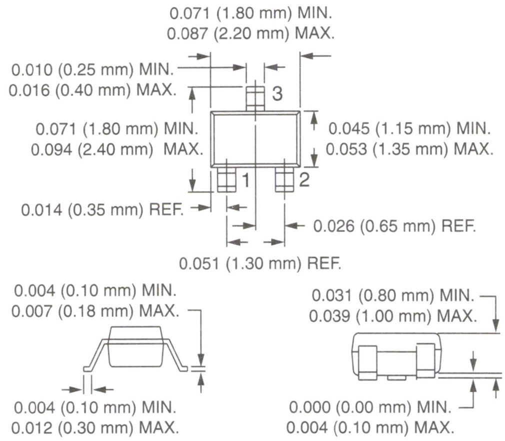
Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)
SMV1405	2.92	0.68	0.41	0.05	0.80
SMV1408	3.70	0.80	0.48	0.13	0.60
SMV1413	9.20	0.79	0.45	0.13	0.35
SMV1417	19.20	0.84	0.48	0.13	0.22
SMV1419	23.40	0.87	0.54	0.13	0.20

1. Values extracted from measured performance.
2. For package inductance (L_S) refer to package type.
3. For more details refer to the "Varactor SPICE Models for RF VCO Applications" Application Note.

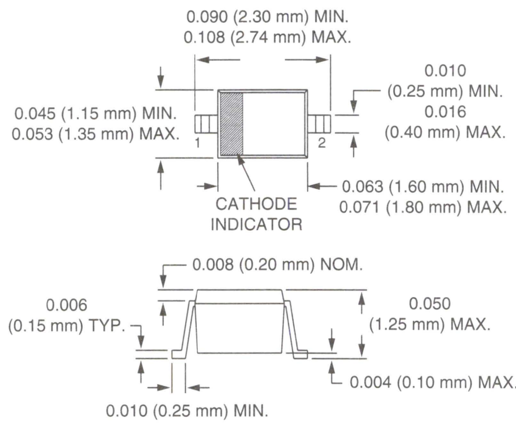
SOT-23



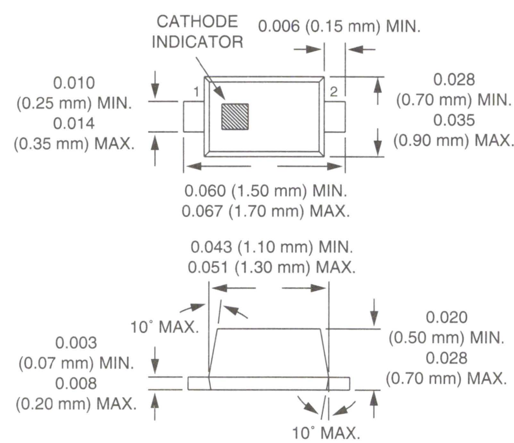
SC-70



SOD-323



SC-79

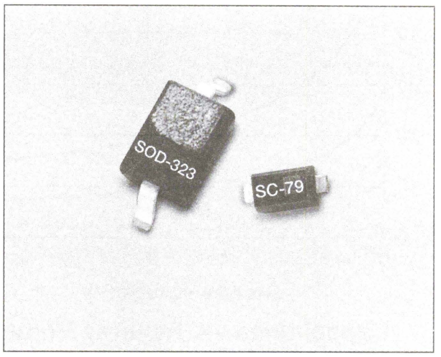


SKYWORKS

SMV1493–SMV1494

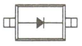
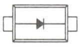
Features

- High Q
- Low Series Resistance for Low Phase Noise
- Multiple Packages: SOD-323 and SC-79
- Designed for High Volume Commercial Applications
- SPICE Models are Available



Description

The SMV1493 and SMV1494 silicon abrupt junction varactor diodes are designed for use in VCOs requiring tight capacitance tolerances. The low resistance of these varactors makes them appropriate for high Q resonators in wireless system VCOs to frequencies beyond 2.5 GHz.

	
Single	Single
SOD-323	SC-79
♦ **SMV1493-011**	♦ **SMV1493-079**
	♦ **SMV1494-079**
L_S = 1.5 nH	L_S = 0.7 nH

♦ Available through distribution.
For other packages or configurations, please contact the factory.

Absolute Maximum Ratings

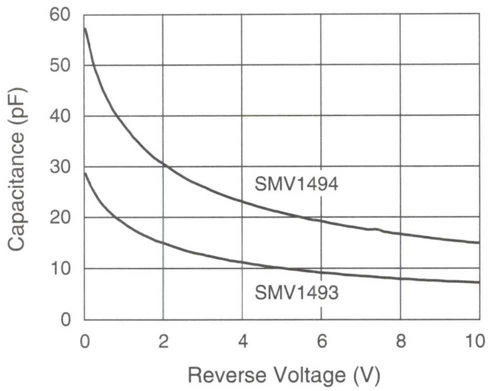
Characteristic	Value
Forward Current (I_F)	20 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-55°C to +150°C
Operating Temperature (T_{OP})	-55°C to +125°C

Electrical Specifications at 25°C

Part Number	C_T @ 1 V (pF)		C_T @ 4 V (pF)		R_S @ 1 V 500 MHz (Ω)
	Min.	**Max.**	**Min.**	**Max.**	**Max.**
SMV1493	17.4	20.0	10.0	12.1	0.50
SMV1494	36.3	41.7	20.7	25.3	0.45

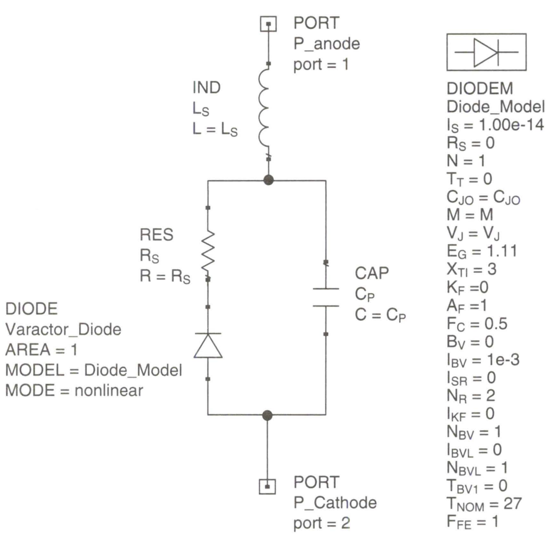
Reverse Voltage V_R (I_R = 10 µA): 12 V
Reverse Current I_R (V_R = 10 V): 20 nA

Typical Performance Data



Capacitance vs. Reverse Voltage

SPICE Model



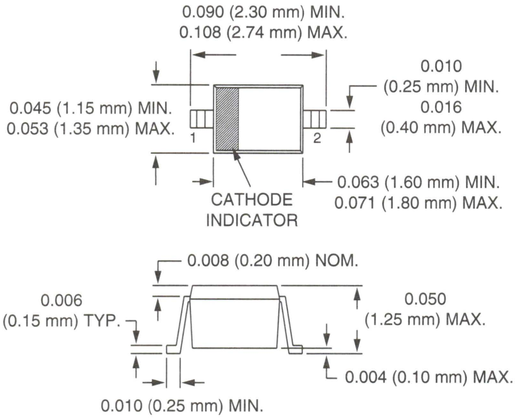
Part Number	C_{JO} (pF)	V_J (V)	M	C_P (pF)	R_S (Ω)
SMV1493	29	0.63	0.47	0	0.50
SMV1494	58	0.63	0.47	0	0.45

1. Values extracted from measured performance.
2. For package inductance (L_S) refer to package type.
3. For more details refer to the "Varactor SPICE Models for RF VCO Applications" Application Note.

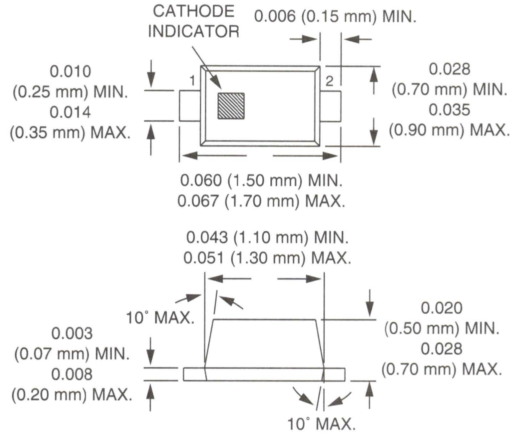
Capacitance vs. Reverse Voltage

	SMV1493	SMV1494
V_R (V)	C_T (pF)	C_T (pF)
0.0	28.7	57.8
0.2	25.6	51.5
0.4	23.3	46.9
0.6	21.5	43.4
0.8	20.1	40.5
1.0	19.0	38.4
1.2	17.9	36.3
1.4	17.0	34.6
1.6	16.2	33.0
1.8	15.5	31.6
2.0	15.0	30.6
2.2	14.4	29.5
2.4	13.9	28.5
2.6	13.5	27.6
2.8	13.1	26.7
3.0	12.7	26.1
3.2	12.4	25.3
3.4	12.0	24.7
3.6	11.7	24.1
3.8	11.4	23.5
4.0	11.2	23.1
4.2	10.9	22.6
4.4	10.7	22.1
4.6	10.5	21.7
4.8	10.3	21.3
5.0	10.1	20.9
6.0	9.2	19.2
7.0	8.5	17.9
8.0	8.0	16.7
9.0	7.6	15.7
10.0	7.1	14.7

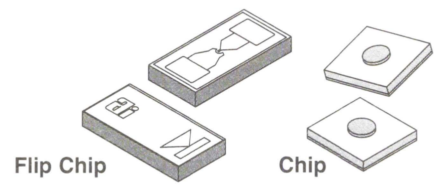
SOD-323


0.090 (2.30 mm) MIN.
0.108 (2.74 mm) MAX.
0.010
(0.25 mm) MIN.
0.016
(0.40 mm) MAX.
0.045 (1.15 mm) MIN.
0.053 (1.35 mm) MAX.
1
2
CATHODE
INDICATOR
0.063 (1.60 mm) MIN.
0.071 (1.80 mm) MAX.
0.008 (0.20 mm) NOM.
0.006
(0.15 mm) TYP.
0.050
(1.25 mm) MAX.
0.004 (0.10 mm) MAX.
0.010 (0.25 mm) MIN.

SC-79


CATHODE
INDICATOR
0.006 (0.15 mm) MIN.
0.010
(0.25 mm) MIN.
0.014
(0.35 mm) MAX.
1
2
0.028
(0.70 mm) MIN.
0.035
(0.90 mm) MAX.
0.060 (1.50 mm) MIN.
0.067 (1.70 mm) MAX.
0.043 (1.10 mm) MIN.
0.051 (1.30 mm) MAX.
10° MAX.
0.003
(0.07 mm) MIN.
0.008
(0.20 mm) MAX.
0.020
(0.50 mm) MIN.
0.028
(0.70 mm) MAX.
10° MAX.

GMV7811, GMV7821
GMV9801, GMV9821, GMV9822



Features

- Constant Gamma of 1.0 and 1.25
- Highly Linear Frequency Tuning
- Constant Modulation Sensitivity
- Lower Series Resistance and Higher Q in Comparison to Equivalent Silicon Hyperabrupt Varactors

Description

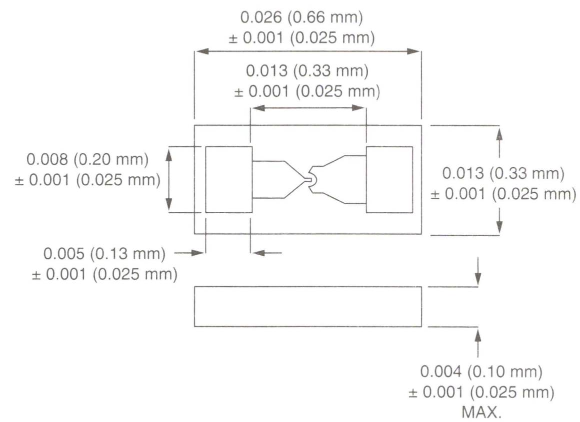
This series of GaAs hyperabrupt varactor diodes features a constant gamma of 1.0 and 1.25, which allows for a relatively linear frequency tuning for VCOs, modulators and tunable filters. Varactors in this series are grown by MBE (Molecular Beam Epitaxy), which allows monolayer control of the doping profile. This translates to superb wafer-to-wafer uniformity. The series resistance is lower, and Q is higher when compared to an equivalent silicon hyperabrupt varactor. These diodes are suited for applications at X band frequencies and above, where wide change in frequency is desired. However, in certain applications the GaAs hyperabrupt varactor exhibits a higher surface noise in comparison to an equivalent silicon varactor.

Absolute Maximum Ratings

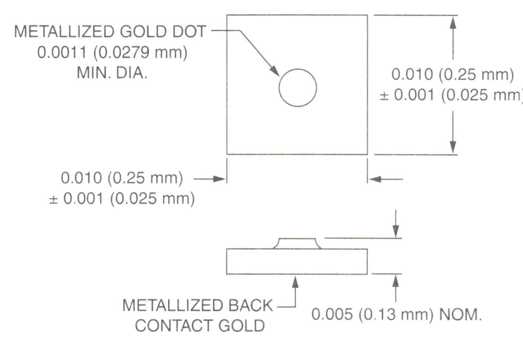
Characteristic	Value
Reverse Voltage (V_R)	18 V
Forward Current (I_F)	100 mA
Power Dissipation at 25°C	250 mW
Operating Temperature (T_{OP})	-55°C to +150°C
Storage Temperature (T_{ST})	-65°C to +200°C

Outline Drawings

540-011



150-808



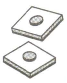
Electrical Characteristics

GaAs Hyperabrupt Junction Varactor Chips

Gamma = 1.0

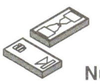
 Part Number	V_B @ 10 µA (V)	I_R @ 14.4 V (nA)	Typical Voltage Range of Gamma (V)	Junction Capacitance C_J @ 4 V (pF)		C_J @ 2 V / C_J @ 12 V (Ratio)		Q @ 4 V 50 MHz	Outline Drawing Number
	Min.	Max.		Min.	Max.	Min.	Max.	Typ.	
GMV7811-000	18	100	2–12	0.4	0.6	3.63	4.43	4000	150-808

Gamma = 1.25

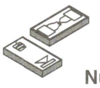
 Part Number	V_B @ 10 µA (V)	I_R @ 14.4 V (nA)	Typical Voltage Range of Gamma (V)	Junction Capacitance (pF)		C_J @ 2 V / C_J @ 12 V (Ratio)		Q @ 4 V 50 MHz	Outline Drawing Number
	Min.	Max.		Min.	Max.	Min.	Max.	Typ.	
GMV9801-000	18	100	2–12	0.3	0.4	5.14	6.28	4000	150-808

GaAs Hyperabrupt Junction Varactor Flip Chips

Gamma = 1.0

 Part Number	V_B @ 10 µA (V)	I_R @ 14.4 V (nA)	Junction Capacitance C_J @ 4 V (pF)		C_J @ 2 V / C_J @ 12 V (Ratio)		Q @ 4 V 50 MHz	Outline Drawing Number
	Min.	Max.	Min.	Max.	Min.	Max.	Typ.	
GMV7821-000	18	100	0.4	0.6	3.30	4.10	4000	540-011

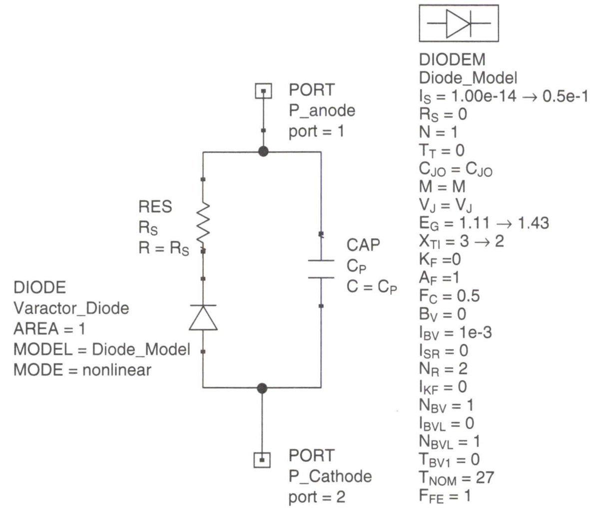
Gamma = 1.25

 Part Number	V_B @ 10 µA (V)	I_R @ 14.4 V (nA)	Junction Capacitance C_J @ 4 V (pF)		C_J @ 2 V / C_J @ 12 V (Ratio)		Q @ 4 V 50 MHz	Outline Drawing Number
	Min.	Max.	Min.	Max.	Min.	Max.	Typ.	
GMV9821-000	18	100	0.3	0.4	4.30	5.27	4000	540-011
GMV9822-000	18	100	0.4	0.6	4.53	5.55	3500	540-011

Typical Capacitance Values

	GMV7811	GMV9801	GMV7821	GMV9821	GMV9822
V_R (V)	C_J (pF)	C_J (pF)	C_J (pF)	C_J (pF)	C_J (pF)
0	1.38	1.12	1.33	1.07	1.55
1	1.03	0.84	1.01	0.81	1.17
2	0.80	0.63	0.79	0.61	0.88
3	0.62	0.45	0.61	0.45	0.64
4	0.50	0.35	0.50	0.35	0.50
5	0.42	0.28	0.42	0.29	0.41
6	0.36	0.23	0.37	0.24	0.34
7	0.32	0.20	0.33	0.21	0.30
8	0.28	0.17	0.30	0.19	0.26
9	0.26	0.15	0.27	0.17	0.23
10	0.23	0.14	0.25	0.15	0.21
11	0.22	0.12	0.23	0.14	0.19
12	0.20	0.11	0.21	0.13	0.18

SPICE Model



$$C_V = \frac{C_{J0}}{\left(1 + \frac{V_R}{V_J}\right)^M} + C_P$$

Part Number	C_{J0} (pF)	V_J (V)	M	C_P (pF)
GMV7811	1.38	5.20	2.10	0.080
GMV9801	1.12	5.50	2.30	0.030
GMV7821	1.33	5.20	2.00	0.080
GMV9821	1.07	5.50	2.40	0.060
GMV9822	1.55	5.50	2.40	0.080

1. Values extracted from measured performance.

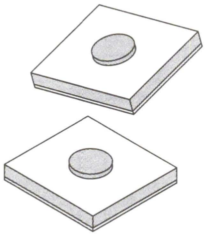
SKYWORKS

Silicon Step Recovery Diode Chips

CVB1031 and CVB1151

Features

- For Frequency Multiplying and Pulse Shaping
- Fast Transition Time for Multiplication to 18 GHz
- Long Carrier Lifetime for Input Frequencies Below 50 MHz
- Rugged, Passivated Chip Design



Description

Skyworks' product line of silicon step recovery diode chips are designed for use in high order frequency multiplier, comb generator and pulse shaping applications. These mesa designed chips have a small outline (12 x 12 mils nominal) and are fully passivated resulting in low leakage current and high reliability. The CVB1031-000 may be used at input frequencies below 50 MHz and will generate harmonics beyond 12 GHz. The CVB1151-000 may be used at input frequencies below 100 MHz and will generate harmonics beyond 18 GHz.

Absolute Maximum Ratings

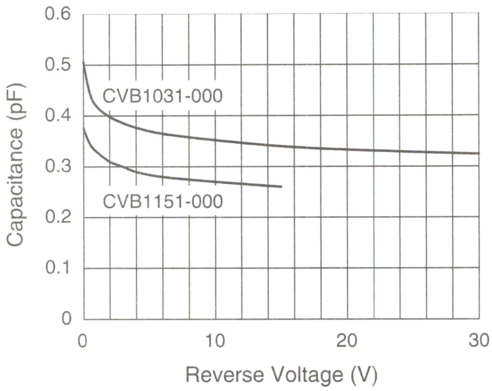
Characteristic	Value
Reverse Voltage (V_R)	Breakdown Voltage
Forward Current (I_F)	100 mA
Power Dissipation (P_D) @ 25°C	250 mW
Operating Temperature (T_{OP})	-55 to +150°C
Storage Temperature (T_{ST})	-65 to +200°C

Electrical Characteristics at 25°C

Part Number	Breakdown Voltage (V)	C_J @ 6 V (pF)		C_J @ 0 V (pF)	Carrier Lifetime (nS)	Transition Time (pS)	Cutoff Frequency (GHz)	Input Frequency (MHz)	Output Frequency (GHz)	Outline Drawing
	Min.	Min.	Max.	Typ.	Min.	Max.	Min.	Typ.	Typ.	
CVB1031-000	30	0.25	0.5	0.5	20	100	300	50–1000	5–12	150-801
CVB1151-000	15	0.25	0.5	0.4	10	70	300	100–3000	9–18	150-806

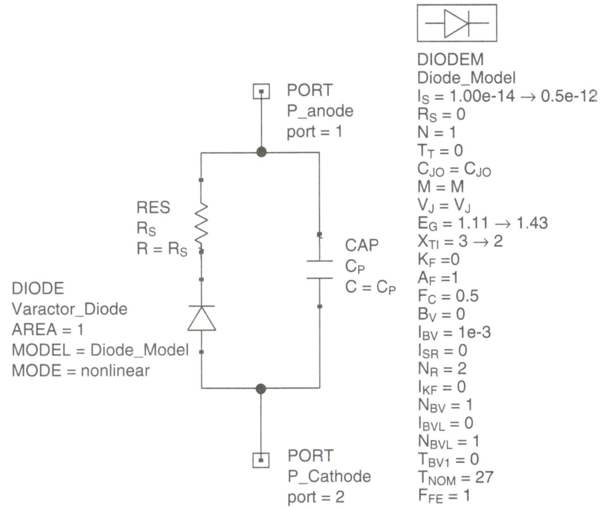
1. Breakdown voltage specified at 10 µA.
2. Capacitance specified at 1 MHz.
3. Carrier lifetime specified at 10 mA.
4. Transition time specified at V_R = 10 V and I_F = 10 mA.
5. Cutoff frequency calculated from C_J @ 6 V and R_S at 100 mA, 100 MHz.

Typical Performance Data



Capacitance vs. Reverse Voltage

SPICE Model

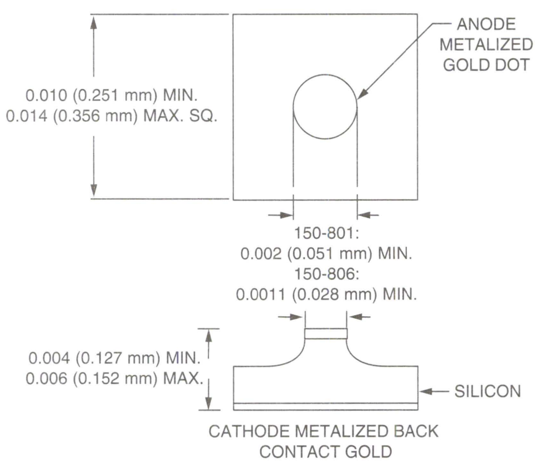


$$C_V = \frac{C_{J0}}{\left(1+\frac{V_R}{V_J}\right)^M} + C_P$$

Parameter	CVB1031-000	CVB1151-000	Units
IS	3E-17	3E-17	A
R_S	0.12	0.13	Ω
N	1.02	1.03	-
TT	2E-8	1E-8	s
C_{J0}	0.20	0.30	pF
C_P	0.31	0.25	pF
M	0.70	1.00	-
E_G	0.69	0.69	eV
XTI	2	2	-
F_C	0.50	0.50	-
B_V	30	15	V
I_{BV}	1.00E-05	1.00E-05	A
V_J	1	2	V

SPICE model parameters extracted from measured values may not reflect exact electronic or physical properties. See application note APN1004.

Outline Drawing



Chip Style	Bonding Pad Nominal (In.)	Chip Size (In.)	
		Min.	Max.
150-801	0.002 (Min.)	0 .010	0.014
150-806	0.0011 (Min.)	0 .010	0.014

PIN Diodes

Application/Selection Guide

New PIN Diodes Designed for Modules

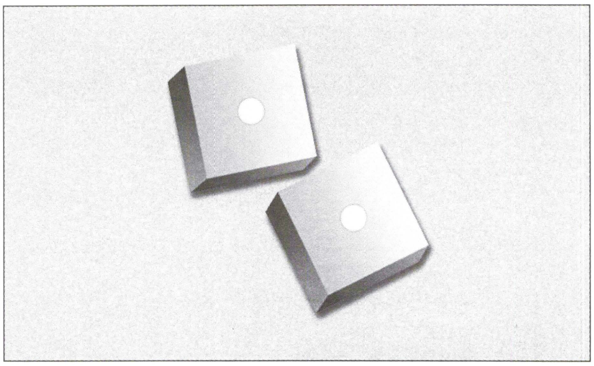
Market	Function	Suggested Part Number
Handset T/R Switch	T/R Switching Band Select Switching	SMP1340-099, SMP1340-050 SMP1353-050
Handset VCO	Band Switching	SMP1340-050, SMP1340-099
Handset PA	General Switching	SMP1320-099, SMP1340-099, SMP1340-050
Bluetooth	T/R Switching	SMP1340-099, SMP1340-050

PIN Diodes

Market	Function	Suggested Part Number
Handsets (400 MHz to 2.4 GHz)	T/R Switching VCO Band Switching Large Signal Switching	SMP1340-079, SMP1320-079, SMP1320-017 SMP1320-079, SMP1322-079 SMP1352-079
Base Station (400 MHz to 2.4 GHz)	General Purpose Switch Attenuator	SMP1340, SMP1321 Series SMP1302 Series, SMP1304 Series, SMP1307 Series
Set Top Converter	Switch	SMP1321 Series
LNB/DBS	Polarization Switch, Switch Matrix	SMP1321-003, SMP1321-004, SMP1321-005
CATV Distribution	Attenuation	SMP1304 Series, SMP1307 Series
CATV	Switching	SMP1320 Series, SMP1352 Series
Telemetry	VCO Band Switching	SMP1322-011
Wireless Meter Reader	Switching	SMP1320-079, SMP1320-011
Electronic Toll Collection (ETC)	Switching	SMP1320-079
Cordless Phones	T/R Switches (900 MHz to 2 GHz)	SMP1320 Series, SMP1340 Series, SMP1321 Series
Pagers	Switch	SMP1320-079, SMP1322-079
Bluetooth	T/R Switching	SMP1340-079
WLAN	T/R Switching	SMP1321-508, SMP1340-508, SMP1340-050

Features

- Designed for High Performance Switch and Attenuator Applications
- Preferred Device for Module Applications
- PIN Diodes Supplied 100% Tested, Sawn, Mounted on Film Frame
- Low Cost



Description

The SMP series of PIN diodes are designed for high volume switch applications from 10 MHz to beyond 2 GHz. The low current, low capacitance performance of these diodes makes the SMP series particularly suited for battery-operated circuits, power amplifier modules, VCO, T/R switches and other applications. The SMP1302-099 and SMP1304-099 parts are designed as a low distortion attenuator used in TV distribution and cellular base station applications.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	50 V
Power Dissipation @ 25°C at the Base of the Chip	250 mW
Storage Temperature	-65°C to +150°C
Operating Temperature	-65°C to +150°C
ESD Human Body Model	Class 1 B

Electrical Specifications at 25°C

Part Number	Min. V_B I_R = 10 µA (V)	Typ. C_J V_R = 0 V F = 1 MHz (pF)	Max. C_J V_R = 10 V F = 1 MHz (pF)	Typ. V_F @ I_F = 10 mA (mV)	Max. R_S I_F = 1 mA F = 100 MHz (Ω)	Max. R_S I_F = 10 mA F = 100 MHz (Ω)	Typical Carrier Lifetime I_F = 10 mA (nsec)
Switching Applications							
SMP1320-099	50	0.23	0.175	850	2.0 Typ.	0.9	400
SMP1322-099	50	1.10	0.850	825	1.5	0.45 Typ.	400
SMP1340-099	50	0.20	0.150	880	1.7 Typ.	1.2	100
SMP1353-099	100	0.35	0.150	825	15	2.8	1000
Attenuator Applications							
SMP1302-099	200	0.27	0.15 @ 30 V	800	20	3.0	700
SMP1304-099	200	0.18	0.15 @ 30 V	800	50	7.0	1000

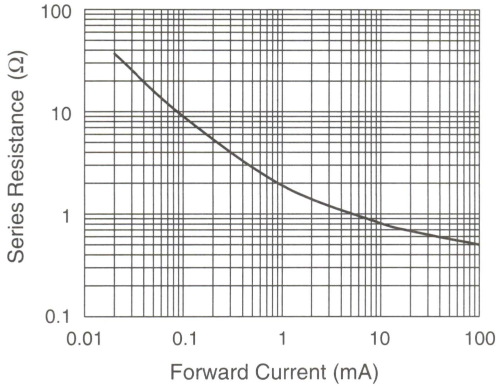
The above PIN diode chips are processed on 100 mm silicon wafers, 100% DC tested, sawn and shipped on 6" film frame hoops.
Electrical rejects are identified with black ink.

Chip Dimensions

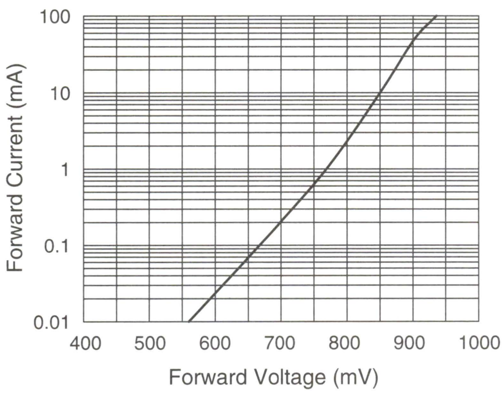
Part Number	Quantity of Good Diodes Per Wafer		Bonding Pad Nominal (In.)	Chip Size Nominal (In.)	Chip Height Nominal (In.)
	Min.	Nom.			
SMP1320-099	40,000	46,000	0.003 ± 0.0003	0.0135 ± 0.001	0.0055 ± 0.0005
SMP1322-099	40,000	46,000	0.0075 ± 0.0003	0.0135 ± 0.001	0.0055 ± 0.0005
SMP1340-099	65,000	72,000	0.003 ± 0.0003	0.0110 ± 0.001	0.0055 ± 0.0005
SMP1353-099	65,000	72,000	0.008 ± 0.0005	0.0110 ± 0.001	0.0055 ± 0.0005
SMP1302-099	40,000	46,000	0.0085 ± 0.0005	0.0135 ± 0.001	0.0055 ± 0.0005
SMP1304-099	40,000	46,000	0.0085 ± 0.0005	0.0135 ± 0.001	0.0100 ± 0.0010

Typical Performance Data at 25°C

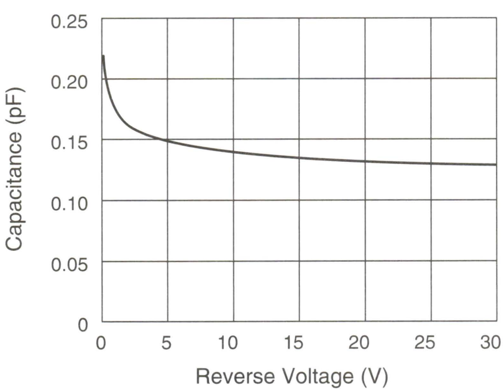
SMP1320



Series Resistance vs. Forward Current @ 100 MHz

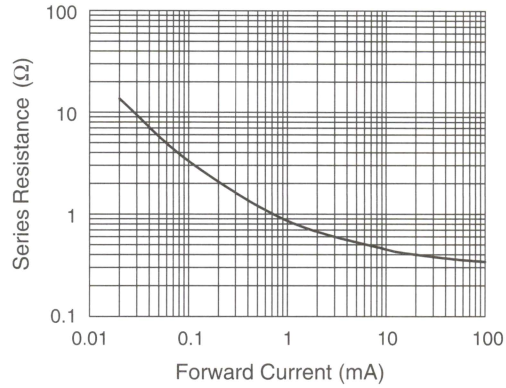


DC Characteristic

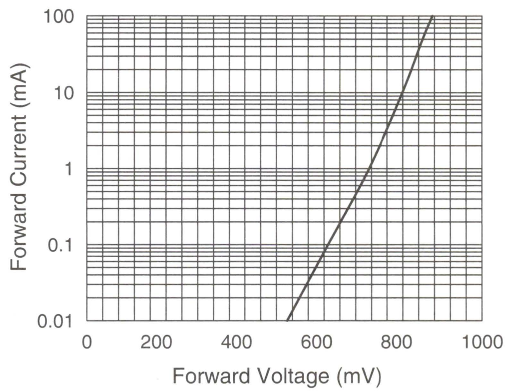


Capacitance vs. Reverse Voltage

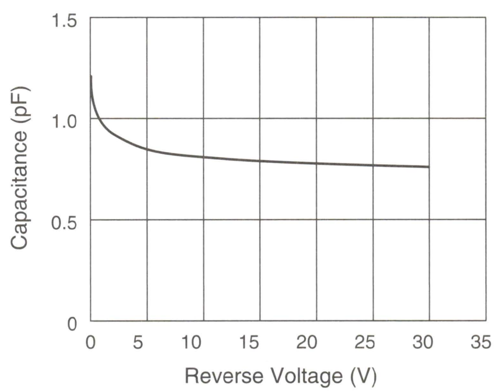
SMP1322



Series Resistance vs. Forward Current @ 100 MHz



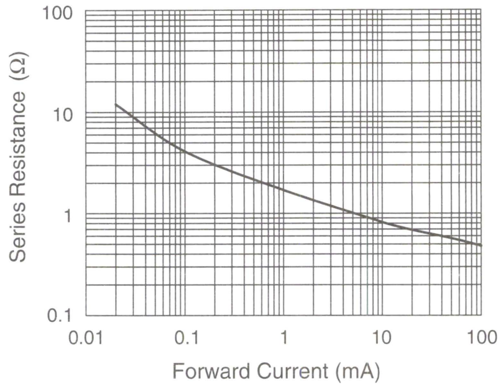
DC Characteristic



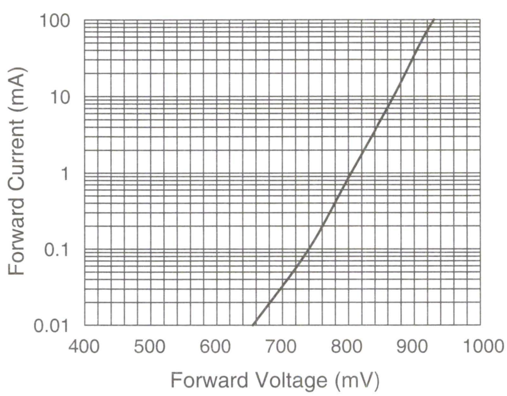
Capacitance vs. Reverse Voltage

Typical Performance Data at 25°C

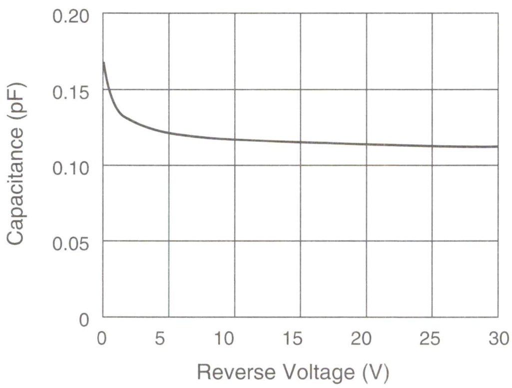
SMP1340



Series Resistance vs. Forward Current @ 100 MHz

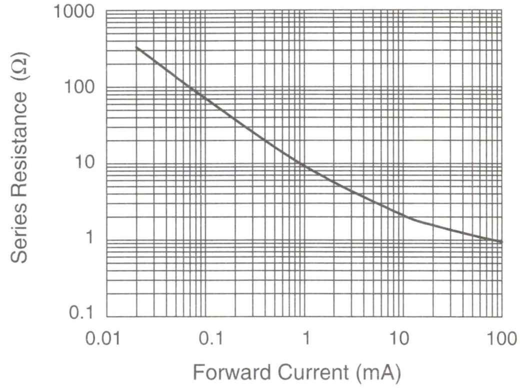


DC Characteristic

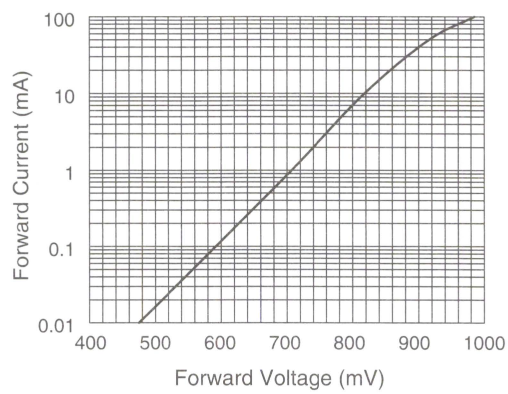


Capacitance vs. Reverse Voltage

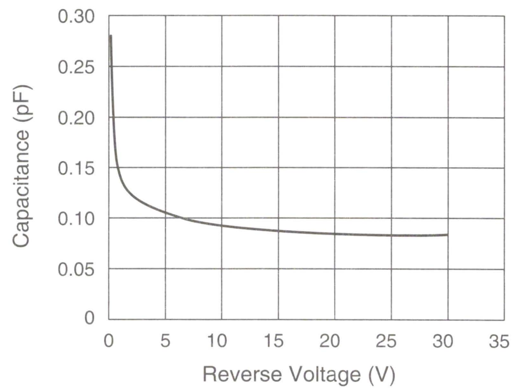
SMP1353



Series Resistance vs. Forward Current @ 100 MHz



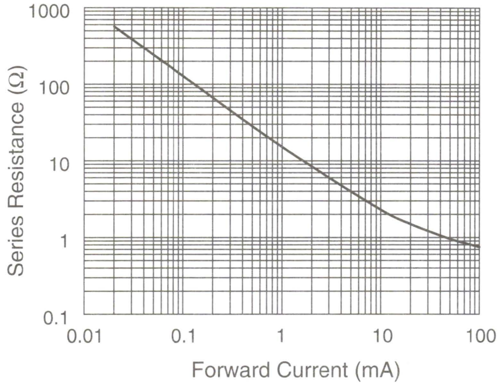
DC Characteristic



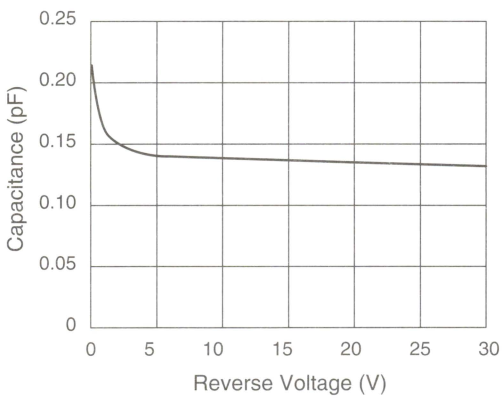
Capacitance vs. Reverse Voltage

Typical Performance Data at 25°C

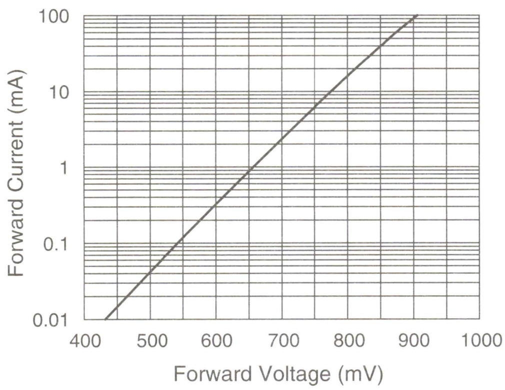
SMP1302



Series Resistance vs. Current @ 100 MHz

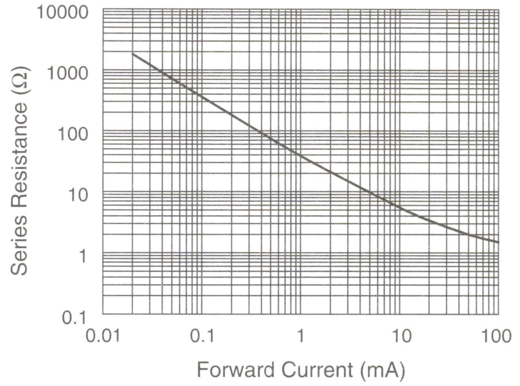


Capacitance vs. Reverse Voltage

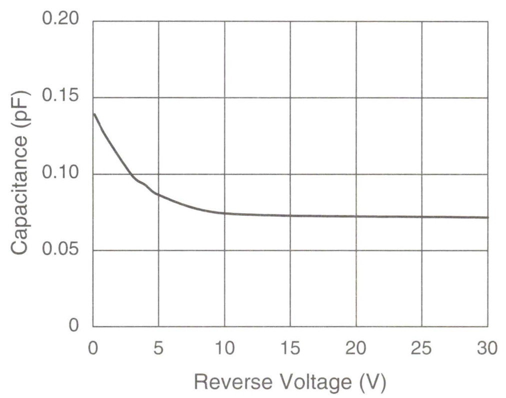


DC Characteristic

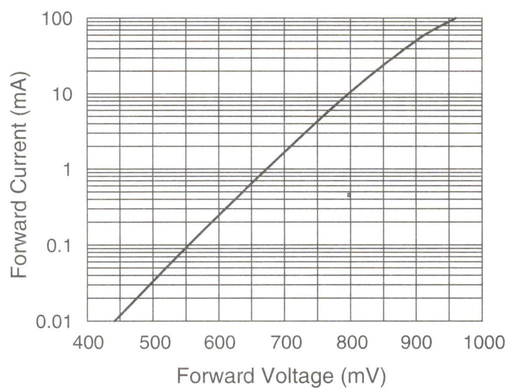
SMP1304



Series Resistance vs. Current @ 100 MHz

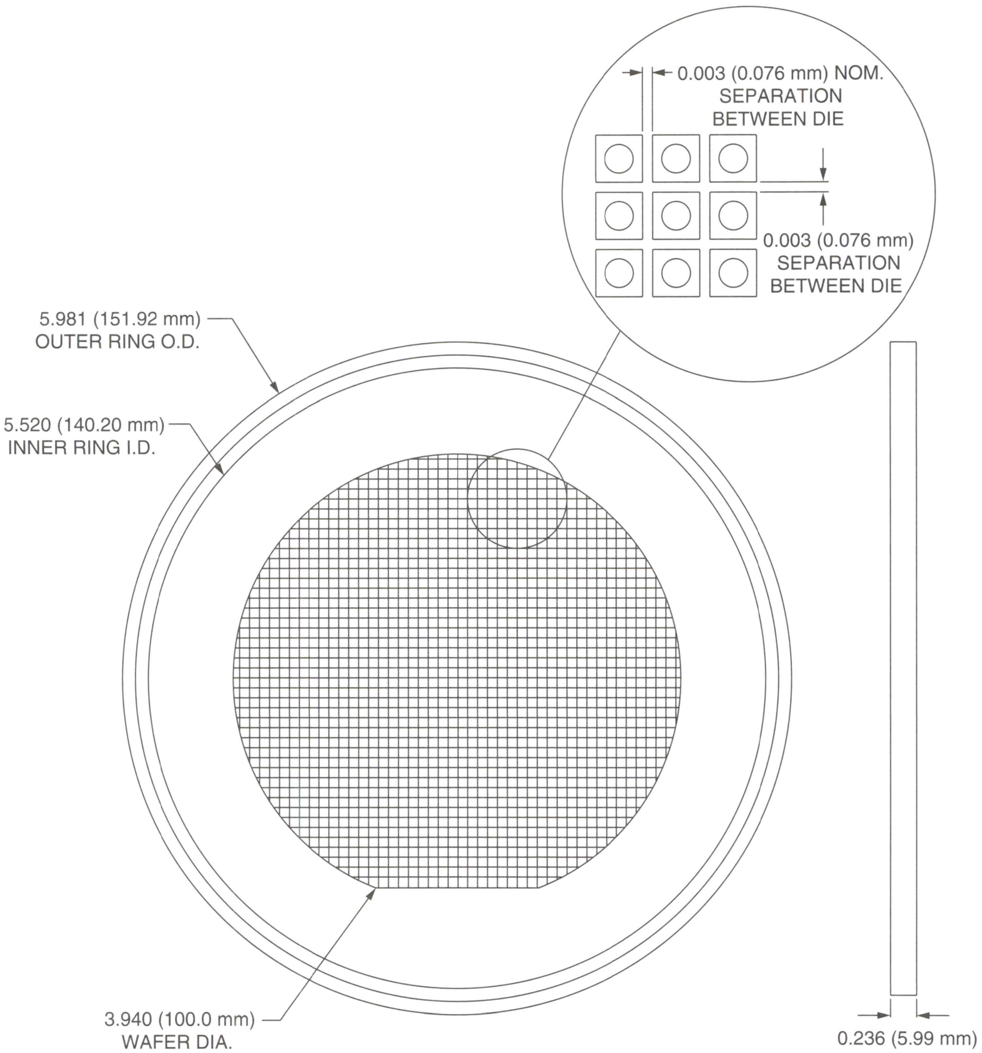


Capacitance vs. Reverse Voltage



DC Characteristic

Wafer On Film



GRIP RING

Wafer Film Frame Description

- Wafer on Nitto Tape
- Color: Light Blue
- Thickness: 2.2–3.0 mils
- Tensile Strength: 6.6 (lbs. in width)
- Ring Material: Plastic

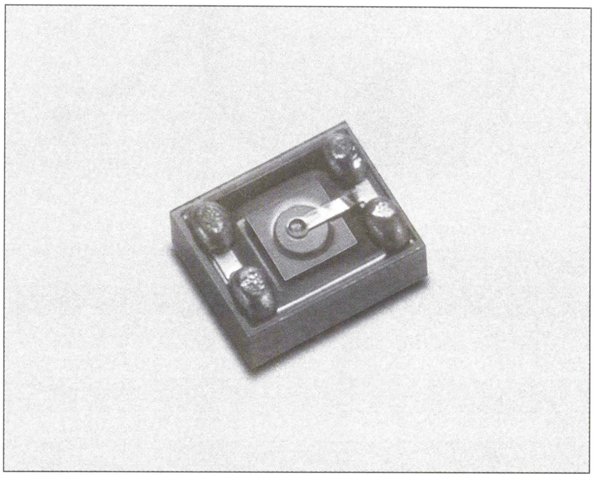
Switching Chip Scale PIN Diodes

SKYWORKS

SMP1340-050, SMP1353-050

Features

- Designed for Fast Speed Wireless Switch Applications
- Very Low Profile, 0.3 mm
- Low Inductance (0.25 nH)
- Designed for High Volume Wireless Applications, Modules, VCOs
- Supplied in Punched Paper Carrier Tape



Description

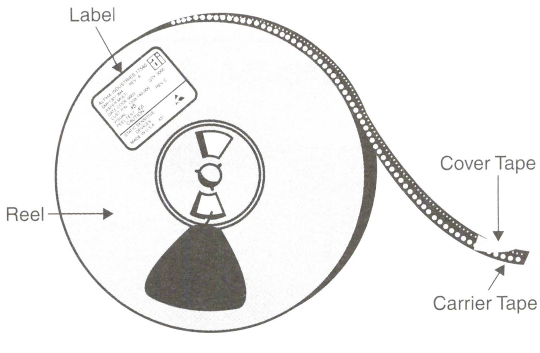
The SMP1340-050 chip scale packaged, surface mountable PIN diode is designed for high volume switch applications from 10 MHz to beyond 5 GHz. The SMP1340-050 has a short carrier lifetime of typically 100 nS, resulting in a fast speed RF switching PIN diode. The RF performance of the SMP1340-050 is assured by virtue of its low capacitance (0.3 pF) and low resistance (1.0 Ω at 10 mA). The SMP1353-050 chip scale packaged, surface mountable, low capacitance (0.3 pF) silicon PIN diode is designed for large signal switch applications from 15 MHz to beyond 5 GHz. These diodes have a reverse voltage rating of 100 V and are designed for use in low distortion switches that are required to hold off large RF voltages. The typical 1.5 µS carrier lifetime, results in a PIN diode with low forward resistance and low distortion characteristics.

Absolute Maximum Ratings

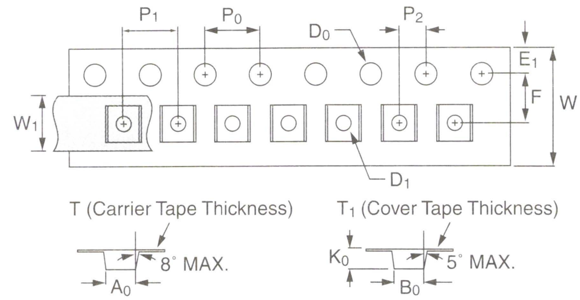
Characteristic	Value
Reverse Voltage (V_R)	50 V
Power Dissipation @ 25°C Lead Temperature (P_D)	250 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C

Electrical Specifications at 25°C

Part Number	Minimum Breakdown Voltage I_R = 10 µA (V)	Maximum Total Capacitance V_R = 20 V f = 1 MHz (pF)	Typical Forward Voltage @ IF = 10 mA (mV)	Maximum Series Resistance IF = 1 mA f = 100 MHz (Ω)	Maximum Series Resistance IF = 10 mA f = 100 MHz (Ω)	Typical Carrier Lifetime IF = 10 mA (nsec)
SMP1340-050	50	0.3	880	2.5	1.2	100
SMP1353-050	100	0.3	825	15	2.8	1000



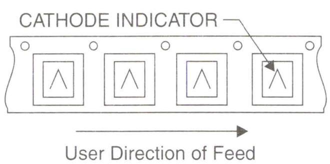
Paper Tape Dimensions



Description	Sym.	Chip Scale
Cavity		
Length	A_0	0.65±0.05
Width	B_0	0.76±0.05
Depth	K_0	0.53±0.05
Pitch	P_1	2.00±0.10
Bottom Hole Diameter	D_1	N/A
Perforation		
Diameter	D_0	1.50±0.10
Pitch	P_0	4.00±0.10
Position	E_1	1.75±0.10
Carrier Tape		
Width	W	8.00±0.20
Thickness	T	0.43±0.05
Cover Tape		
Width	W_1	5.40±0.10
Tape Thickness	T_1	0.062±0.01
Distance		
Cavity to Perforation (Width Direction)	F	3.50±0.05
Cavity to Perforation (Length Direction)	P_2	1.00±0.025

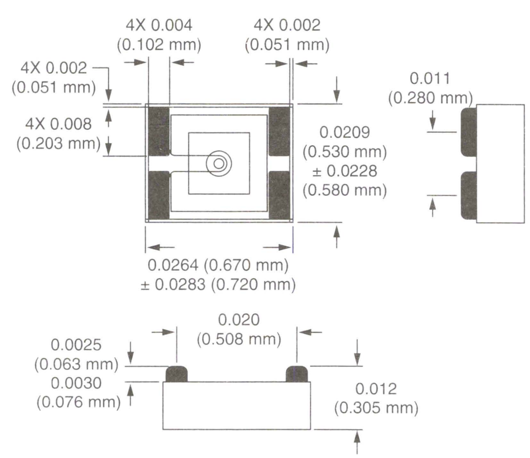
Note: All dimensions are in mm.

Chip Scale (-050)



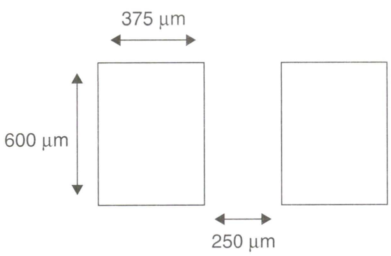
Standard Reel Size	7"
Standard Reel Quantity	12,000

-050



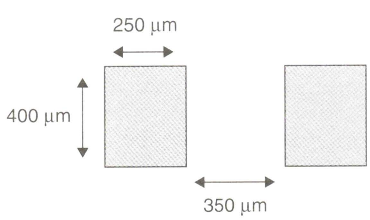
Land Pattern

The recommended surface mount pad pattern ensures quality solder joint formation and high-yielding assembly, while using minimum board space. The dimensions apply to both Solder Mask Defined (SMD) as well as Non-Solder Mask Defined (NSMD) pads. However, NSMD pads, in which the solder mask is pulled back from the metal pad, are preferred. This type of pad definition generally produces improved solder joint reliability as well as an increased gap under the component. The increased gap is desirable for enhanced cleaning of flux residue and component underfill for applications in which the component will be encapsulated.

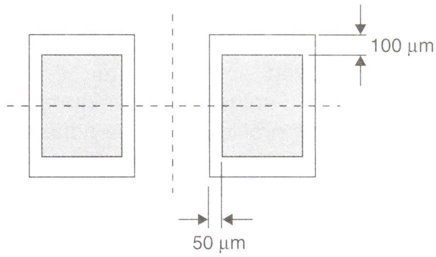


Solder Printing

The recommended land pattern, when used in conjunction with the following solder deposit recommendation, provides quality solder joint formation and high yielding assembly. Solder should be deposited with a stencil of foil thickness from 100–125 μm, and preferably have apertures that are laser-etched and electro-polished for optimal paste release. The chip scale package is compatible with most lead-based and lead-free solder pastes, though a type 3 or type 4 paste is preferred for the fine aperture printing.

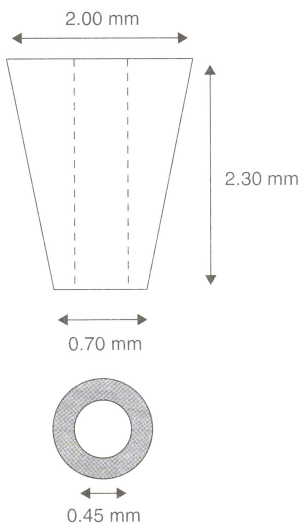


The solder deposit should be centered on the land pattern as shown.



Component Placement

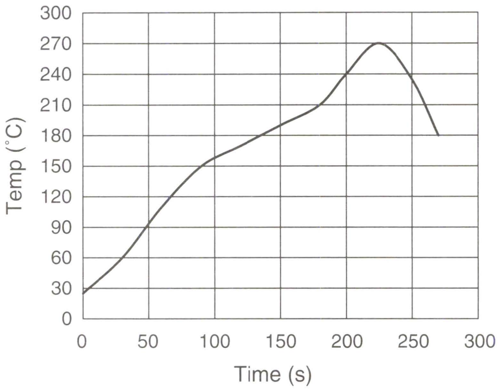
The CSP can easily be picked and placed on most placement systems. Care should be taken to select a pick nozzle that matches the component footprint. Vision alignment after pick can be done to the package edges or the package leads, depending on the ability of the individual placement machine. The component should be placed as centered as possible to the pad and print patterns to assure even wetting and an absence of tilt or skew.



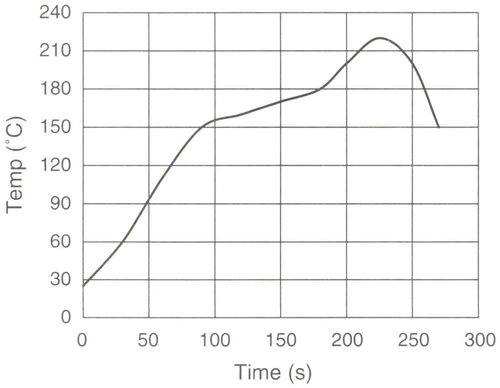
Solder Reflow

Solder reflow is best suited to convection or IR reflow systems, though convection reflow will always give more rapid and uniform thermal transfer. The CSP can be successfully reflowed in either air or nitrogen atmospheres. The solder paste manufacturer's recommended reflow profile should be adhered to and care should be taken to ensure that the profile is adjusted for variability in thermal mass amongst components. Attached are generic profiles for eutectic tin-lead solder and a typical lead-free solder.

These should only be used as a guideline, with the paste manufacturers recommended profile taking precedence. A standard solvent flux clean can be safely employed to remove flux residue from the device edges.



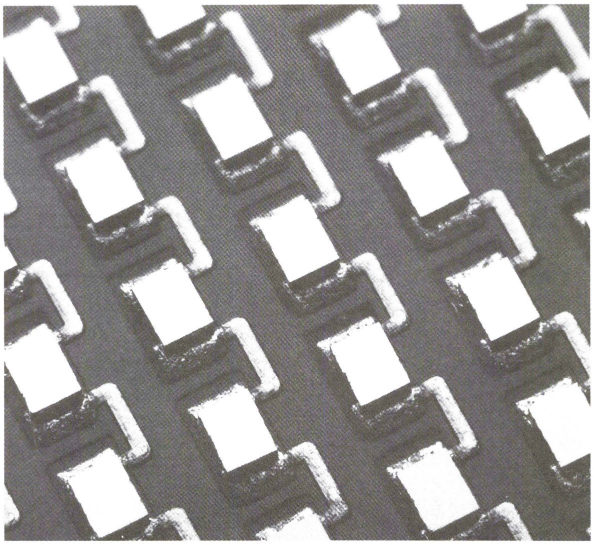
Lead Free Profile



Eutectic Tin-Lead Profile

Finished Product

Once reflowed, the component should be fairly centered on the land pattern. Solder should wet evenly to CSP leads and the component should not display excessive tilt or skew. A solvent flux clean can be safely employed if desired.



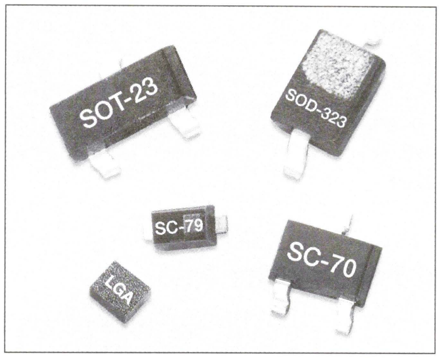
Fast Switching Speed, Low Capacitance Plastic Packaged PIN Diodes

SKYWORKS

SMP1340 Series

Features

- Designed for Fast Speed Wireless Switch Applications
- 1.0 Ω Resistance, 0.3 pF Capacitance
- Available Lead (Pb)-Free MSL-1 @ 250°C per JEDEC J-STD-020
- Available in Tape and Reel Packaging



Description

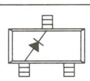
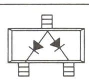
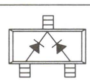
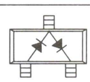
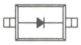
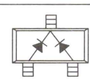
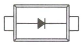
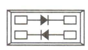
The SMP1340 series of plastic packaged, surface mountable PIN diodes are designed for high volume switch applications from 10 MHz to beyond 2 GHz. The short carrier lifetime of typically 100 nS, combined with its thin I region width of nominally 7 µm, results in a fast speed RF switching PIN diode. The RF performance of the SMP1340 series is assured by virtue of its low capacitance (0.3 pF) and low resistance (1.0 Ω at 10 mA).

The SMP1340-508 has been specifically designed for WLAN 802.11 a, b, and g applications.

NEW Lead (Pb)-Free "environmentally friendly" packaging available: Skyworks offers the SMP1340-079LF and SMP1340-508 Lead (Pb)-Free package as a green alternative.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	50 V
Power Dissipation @ 25°C Lead Temperature (P_D)	250 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
ESD Human Body Model	Class 1B

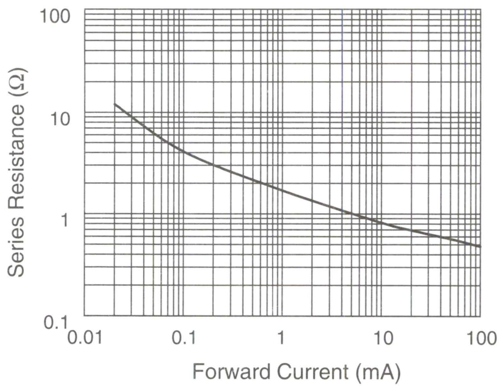
							
Single	Common Anode	Common Cathode	Series Pair	Single	Common Cathode	Single	Anti-Parallel
Marking: PS1	Marking: PS9	Marking: PS3	Marking: PS2		Marking: PS3		Marking: X
SOT-23	SOT-23	SOT-23	SOT-23	SOD-323	SC-70	SC-79	LGA
SMP1340-001	**SMP1340-003**	**SMP1340-004**	**SMP1340-005**	**SMP1340-011**	**SMP1340-074**	**SMP1340-079**	**SMP1340-508**
						SMP1340-079LF	
L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.4 nH	L_S = 0.7 nH	L_S = 0.6 nH

LF denotes Lead (Pb)-Free packaging.

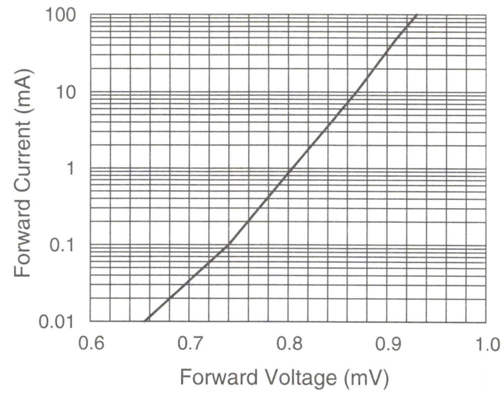
Electrical Specifications at 25°C

Parameter	Condition	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 50 V		10	μA
Capacitance (C_T)	F = 1 MHz, V = 5 V	0.21	0.30	pF
Resistance (R_S)	F = 100 MHz, I = 1 mA	1.7		Ω
Resistance (R_S)	F = 100 MHz, I = 5 mA	1.0	2.0	Ω
Resistance (R_S)	F = 100 MHz, I = 10 mA	0.85	1.2	Ω
Forward Voltage (V_F)	IF = 10 mA	0.85		V
Carrier Lifetime (Tl)	IF = 10 mA	100		nS
I Region Width		7		μm

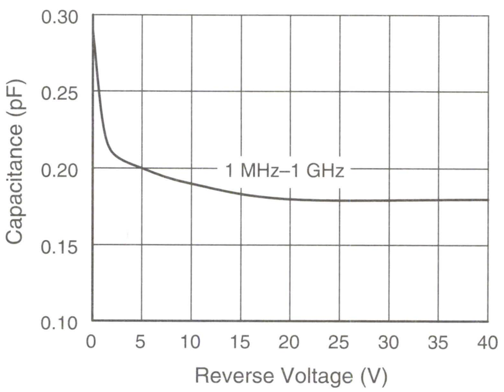
Typical Performance Data



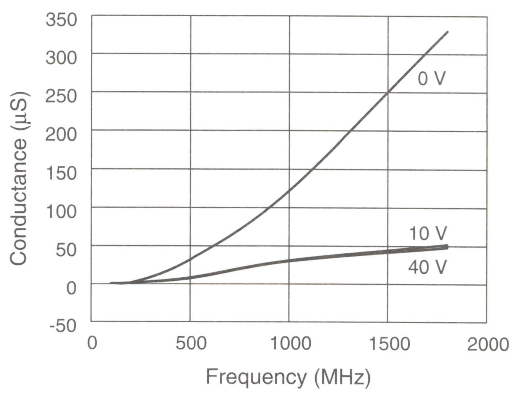
Series Resistance vs. Current @ 100 MHz



DC Characteristic



Capacitance vs. Reverse Voltage

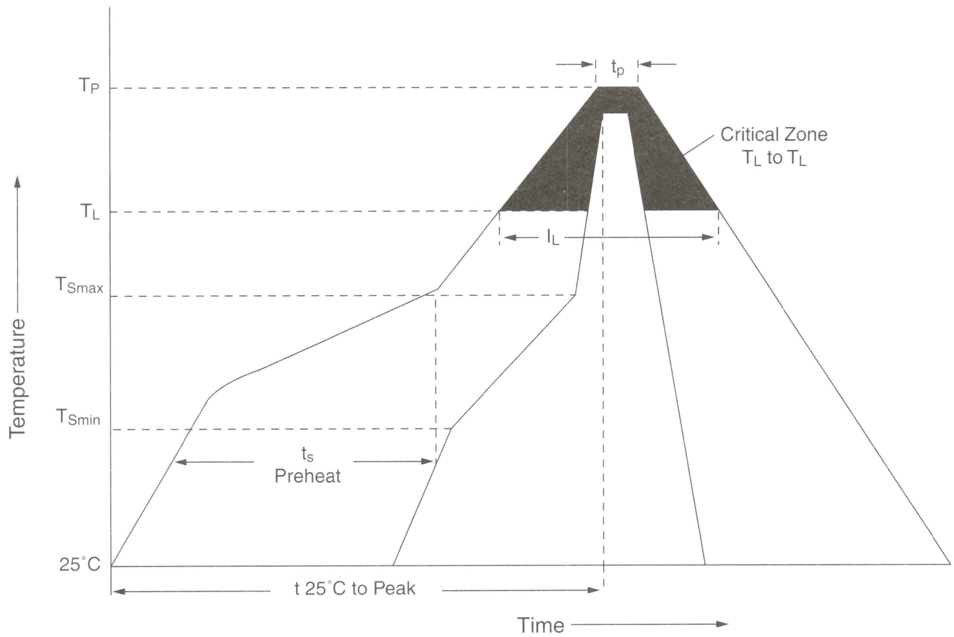


Conductance vs. Frequency and Reverse Voltage

Recommended Solder Reflow Profiles

Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average Ramp-Up Rate (T_L to T_P)	3°C/Second Max.	3°C/Second Max.
Preheat Temperature Min. (T_{Smin}) Temperature Max. (T_{Smax}) Time (Min. to Max.) (ts)	 100°C 150°C 60–120 Seconds	 150°C 200°C 60–80 Seconds
T_{Smax} to T_L Ramp-up Rate	—	3°C/Second Max.
Time Maintained Above: Temperature (T_L) Time (t_L)	 183°C 60–150 Seconds	 217°C 60–150 Seconds
Peak Temperature (T_P)	240 +0/-5°C	250 +0/-5°C
Time Within 5°C of Actual Peak Temperature (tp)	10–30 Seconds	20–40 Seconds
Ramp-Down Rate	6°C/Second Max.	6°C/Second Max.
Time 25°C to Peak Temperature	6 Minutes Max.	8 Minutes Max.

All temperatures refer to the topside of the package, measured on the package body surface.
Reference JEDEC J-STD-020B.

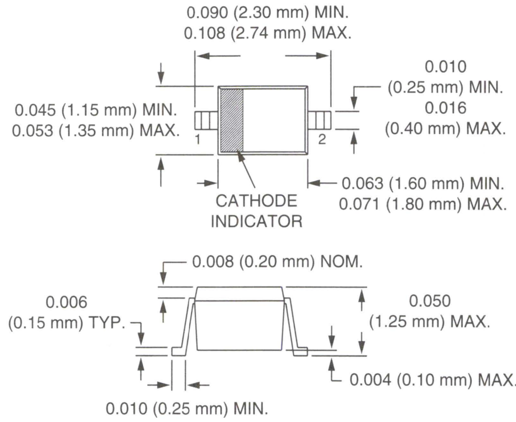


Reference JEDEC J-STD-020

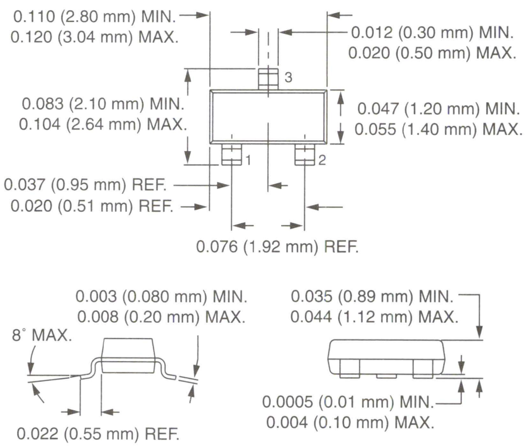
Resistance vs. Temperature @ 500 MHz

I_F (mA)	R -55°C (Ω)	R -40°C (Ω)	R -15°C (Ω)	R +25°C (Ω)	R +65°C (Ω)	R +85°C (Ω)	R +100°C (Ω)
0.02	9.92	9.68	9.30	8.95	8.95	9.01	9.12
0.10	3.90	3.86	3.79	3.80	3.85	3.94	4.03
0.30	2.32	2.33	2.30	2.33	2.35	2.43	2.49
0.50	1.91	1.93	1.90	1.92	1.92	1.99	2.05
1.00	1.54	1.55	1.52	1.53	1.50	1.56	1.61
10.00	0.95	0.96	0.91	0.90	0.82	0.85	0.89
20.00	0.86	0.87	0.82	0.81	0.73	0.75	0.79
100.00	0.72	0.73	0.70	0.68	0.59	0.62	0.65

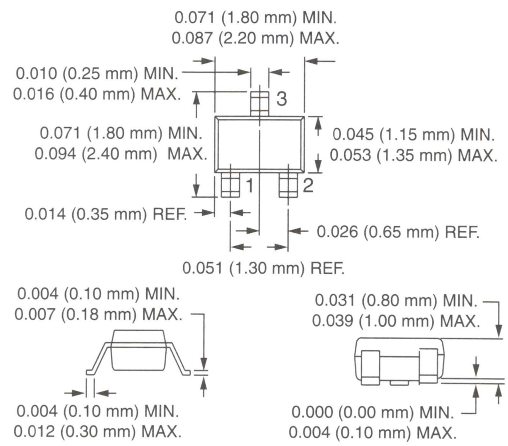
SOD-323



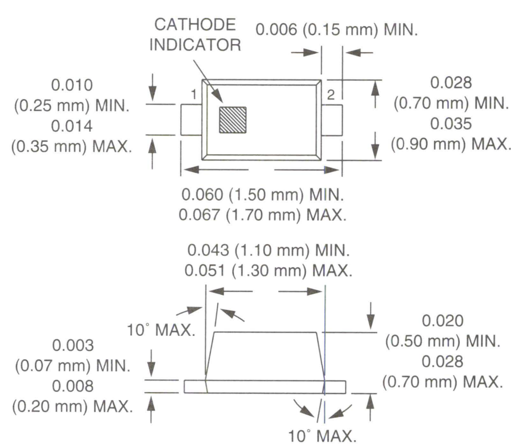
SOT-23



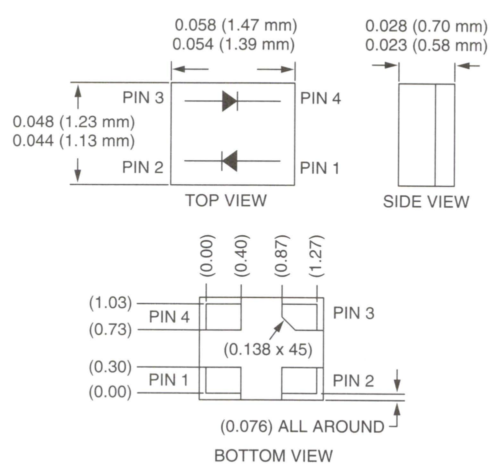
SC-70



SC-79



LGA



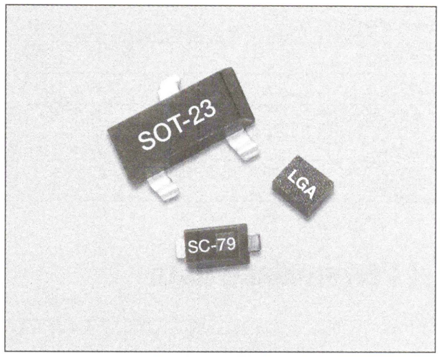
Very Low Capacitance Plastic Packaged PIN Diodes

SKYWORKS

SMP1345 Series

Features

- Designed for High Isolation LNB, WLAN and Wireless Switch Applications
- 0.15 pF Capacitance
- Available Lead (Pb)-Free MSL-1 @ 250°C per JEDEC J-STD-020
- Available in Tape and Reel Packaging



Description

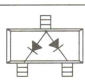
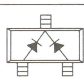
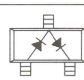
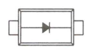
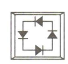
The SMP1345 series of plastic packaged, surface mountable PIN diodes are designed for high volume LNB, WLAN and switch applications from 10 MHz to beyond 2 GHz. The short carrier lifetime of typically 100 nS, combined with its thin I region width of nominally, 10 μm, results in a fast speed RF switching PIN diode. The RF performance of the SMP1345 series is assured by virtue of its very low capacitance (0.15 pF) and low resistance (1.5 Ω at 10 mA).

The SMP1345-518 has been specifically designed for WLAN 802.11 a, b, and g applications.

NEW Lead (Pb)-Free "environmentally friendly" packaging available: Skyworks offers the SMP1345-079LF and SMP1345-518 Lead (Pb)-Free package as a green alternative.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	50 V
Power Dissipation @ 25°C Lead Temperature (P_D)	250 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
ESD Human Body Model	Class 1B

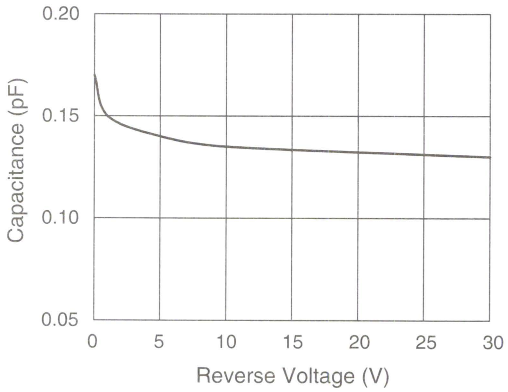
				
Common Anode	Common Cathode	Series Pair	Single	Ring
Marking: PU9	Marking: PU3	Marking: PU2		
SOT-23	SOT-23	SOT-23	SC-79	LGA
SMP1345-003	**SMP1345-004**	**SMP1345-005**	**SMP1345-079**	**SMP1345-518**
			SMP1345-079LF	
L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 0.7 nH	L_S = 0.6 nH

LF denotes Lead (Pb)-Free packaging.

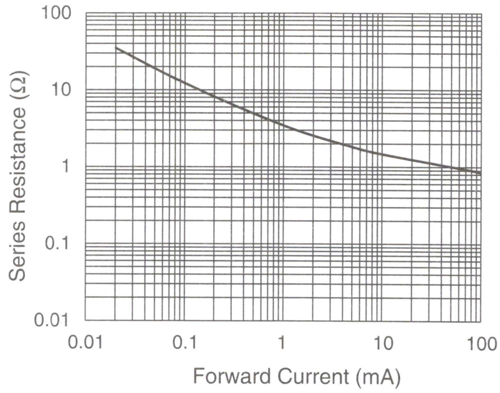
Electrical Specifications at 25°C

Parameter	Condition	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 50 V		10	μA
Capacitance (C_T)	F = 1 MHz, V = 1 V	0.19		pF
Capacitance (C_T)	F = 1 MHz, V = 5 V	0.18	0.20	pF
Resistance (R_S)	F = 100 MHz, I = 1 mA	3.50		Ω
Resistance (R_S)	F = 100 MHz, I = 10 mA	1.50	2.00	Ω
Forward Voltage (V_F)	IF = 10 mA	0.89		V
Carrier Lifetime (TI)	IF = 10 mA	100		nS
I Region Width		10		μm

Typical Performance Data



Total Capacitance vs. Reverse Voltage Measured in an SC-79 Package

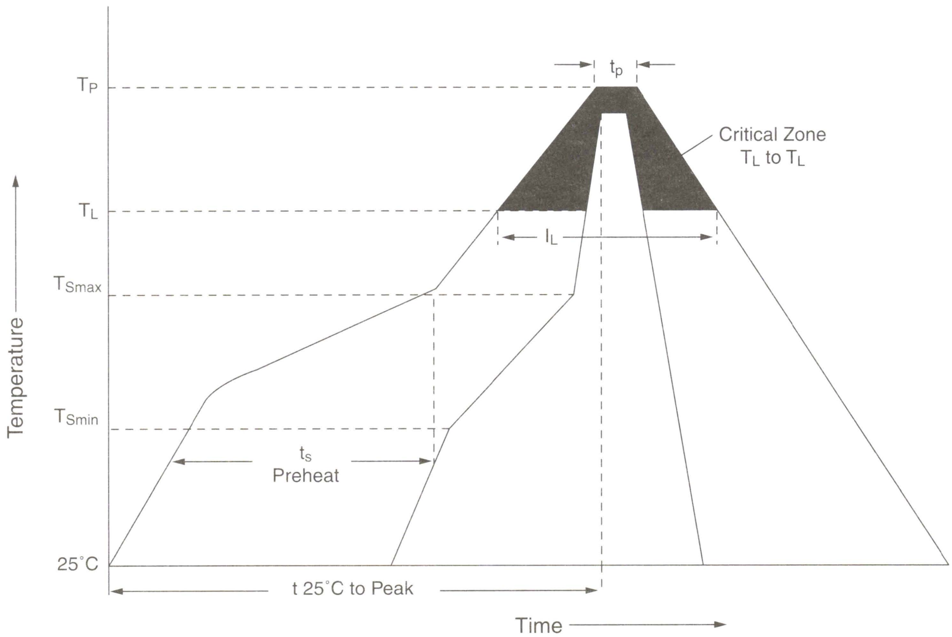


Series Resistance vs. Current @ 100 MHz

Recommended Solder Reflow Profiles

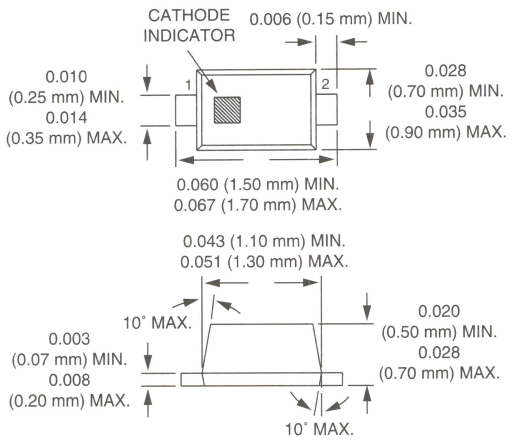
Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average Ramp-Up Rate (T_L to T_P)	3°C/Second Max.	3°C/Second Max.
Preheat Temperature Min. (T_{Smin}) Temperature Max. (T_{Smax}) Time (Min. to Max.) (ts)	 100°C 150°C 60–120 Seconds	 150°C 200°C 60–80 Seconds
T_{Smax} to T_L Ramp-up Rate	—	3°C/Second Max.
Time Maintained Above: Temperature (T_L) Time (t_L)	 183°C 60–150 Seconds	 217°C 60–150 Seconds
Peak Temperature (T_P)	240 +0/-5°C	250 +0/-5°C
Time Within 5°C of Actual Peak Temperature (tp)	10–30 Seconds	20–40 Seconds
Ramp-Down Rate	6°C/Second Max.	6°C/Second Max.
Time 25°C to Peak Temperature	6 Minutes Max.	8 Minutes Max.

All temperatures refer to the topside of the package, measured on the package body surface.
Reference JEDEC J-STD-020B.

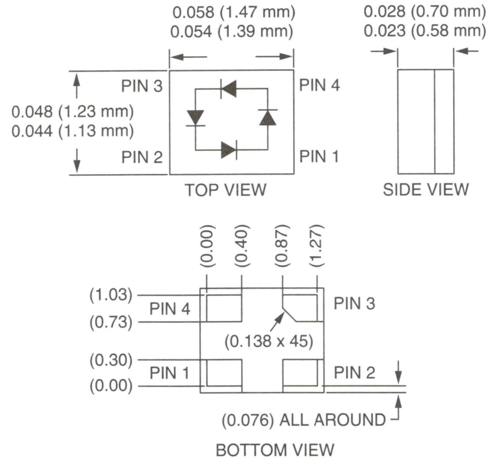


Reference JEDEC J-STD-020

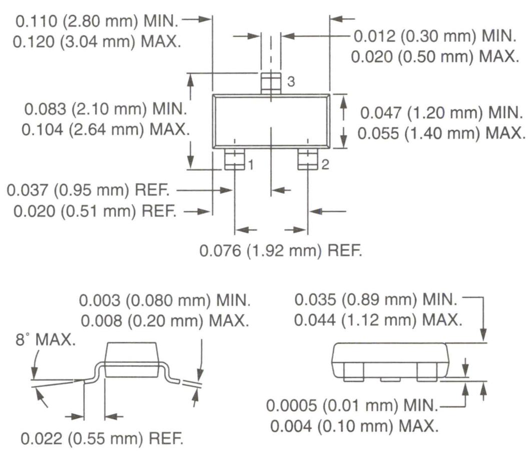
SC-79



LGA



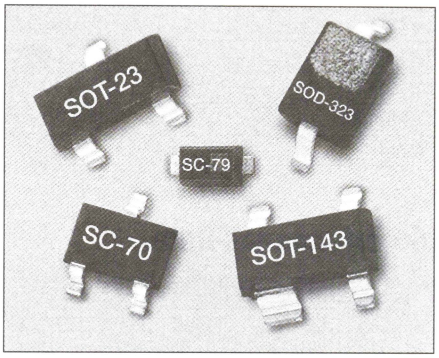
SOT-23



Low Resistance Low Capacitance Plastic Packaged PIN Diodes

SKYWORKS

SMP1320 Series



Features

- Designed for High Performance Wireless Switch Applications
- 0.9 Ω Resistance, 0.3 pF Capacitance
- Available Lead (Pb)-Free MSL-1 @ 250°C per JEDEC J-STD-020
- Available in Tape and Reel Packaging

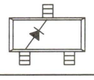
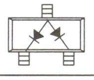
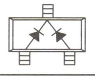
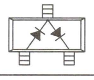
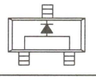
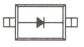
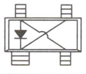
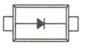
Description

The SMP1320 series of plastic packaged, surface mountable PIN diodes are designed for high volume switch applications from 10 MHz to beyond 2 GHz. The low current performance of these diodes (0.9 Ω maximum at 10 mA and 2 Ω typical at 1 mA) make the SMP1320 series particularly suited to battery operated circuits. Available in a selection of plastic packages and in a variety of configurations including a low inductance (0.4 nH) SOT-23 (SMP1320-007), the small footprint SC-79 and the miniature SC-70.

NEW Lead (Pb)-Free "environmentally friendly" packaging available: Skyworks offers the SMP1320-079LF Lead (Pb)-Free package as a green alternative.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	50 V
Power Dissipation @ 25°C Lead Temperature (P_D)	250 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
ESD Human Body Model	Class 1B

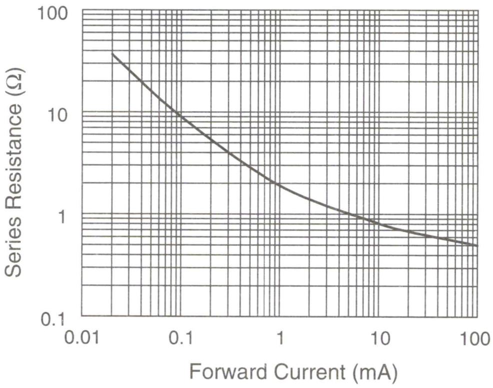
							
Single	Common Anode	Common Cathode	Series Pair	Low Inductance	Single	Ultra Low Inductance	Single
Marking: PL1	Marking: PL9	Marking: PL3	Marking: PL2	Marking: PLB		Marking: PLF	
SOT-23	SOT-23	SOT-23	SOT-23	SOT-23	SOD-323	SOT-143	SC-79
SMP1320-001	**SMP1320-003**	**SMP1320-004**	**SMP1320-005**	**SMP1320-007**	**SMP1320-011**	**SMP1320-017**	**SMP1320-079**
							SMP1320-079LF
L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 0.4 nH	L_S = 1.5 nH	L_S = 0.2 nH	L_S = 0.7 nH
		SC-70	SC-70	SC-70			
		SMP1320-074	**SMP1320-075**	**SMP1320-077**			
		L_S = 1.4 nH	L_S = 1.4 nH	L_S = 0.4 nH			

LF denotes Lead (Pb)-Free packaging.

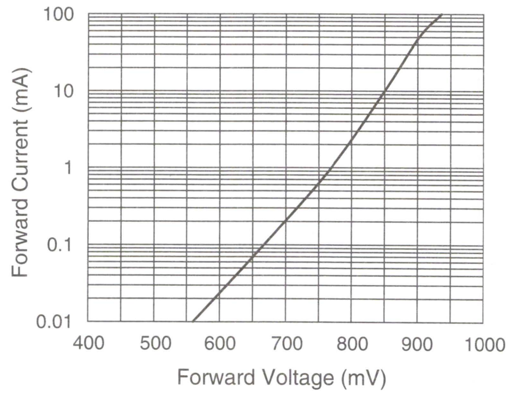
Electrical Specifications at 25°C

Parameter	Condition	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 50 V		10	µA
Capacitance (C_T)	F = 1 MHz, V = 30 V		0.30	pF
Resistance (R_S)	F = 100 MHz, I = 1 mA	2.0		Ω
Resistance (R_S)	F = 100 MHz, I = 10 mA		0.9	Ω
Forward Voltage (V_F)	IF = 10 mA	0.85		V
Carrier Lifetime (TI)	IF = 10 mA	0.4		µS
I Region Width		8		µm

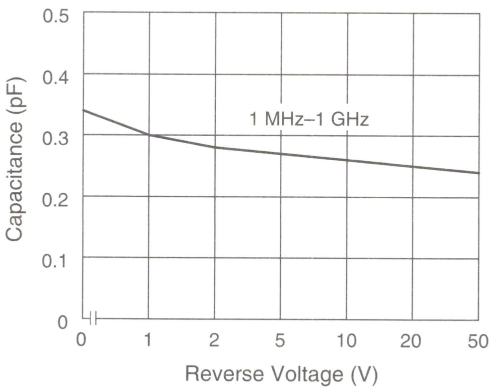
Typical Performance Data



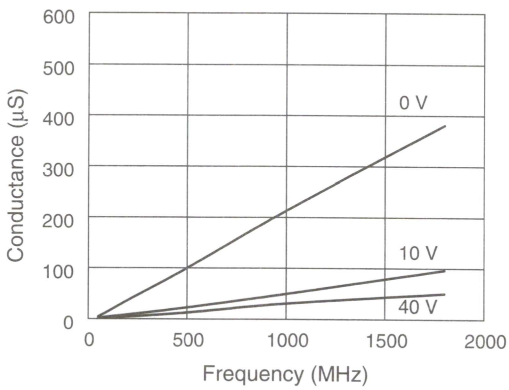
Series Resistance vs. Current @ 100 MHz



DC Characteristic



Capacitance vs. Reverse Voltage

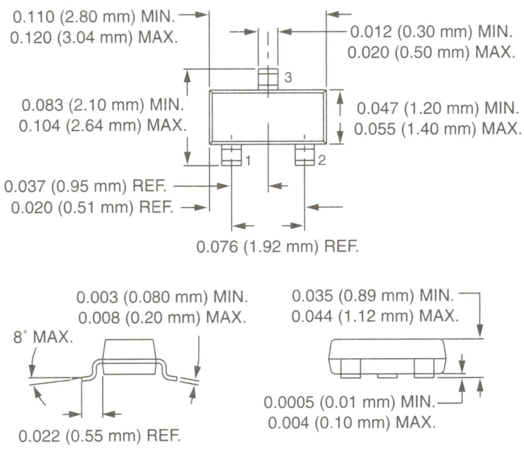


Conductance vs. Frequency and Reverse Voltage

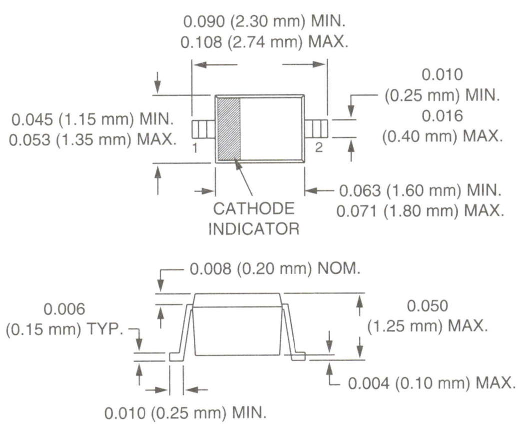
Resistance vs. Temperature @ 500 MHz

I_F (mA)	R_S -55°C (Ω)	R_S -15°C (Ω)	R_S +25°C (Ω)	R_S +65°C (Ω)	R_S +100°C (Ω)
0.02	29.60	29.20	30.80	32.00	32.70
0.10	7.20	7.70	8.30	8.80	8.80
0.30	3.40	3.60	3.80	4.00	4.10
0.50	2.50	2.70	2.80	2.90	3.00
1.00	1.70	1.80	1.90	2.00	1.90
10.00	0.84	0.85	0.76	0.76	0.67
20.00	0.73	0.73	0.64	0.64	0.56
100.00	0.59	0.57	0.47	0.48	0.40

SOT-23



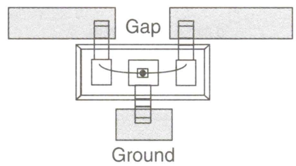
SOD-323



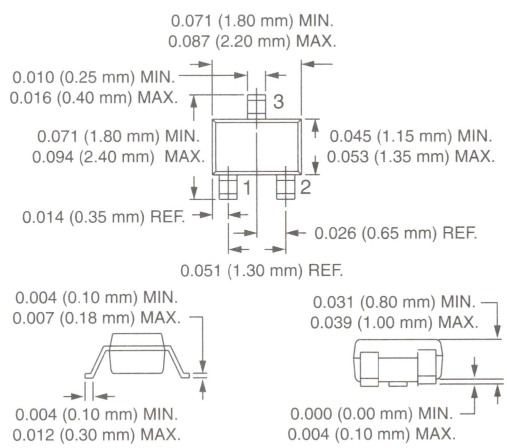
SMP1320-007

In the -007 configuration of the SOT-23 package, the package inductance is effectively reduced to 0.4 nH, in comparison to the 1.5 nH value of the standard configuration. This lower inductance will be particularly beneficial when the diodes are used as shunt connected switches at frequencies higher than 500 MHz, where inductance is the primary limitation on maximum switch isolation.

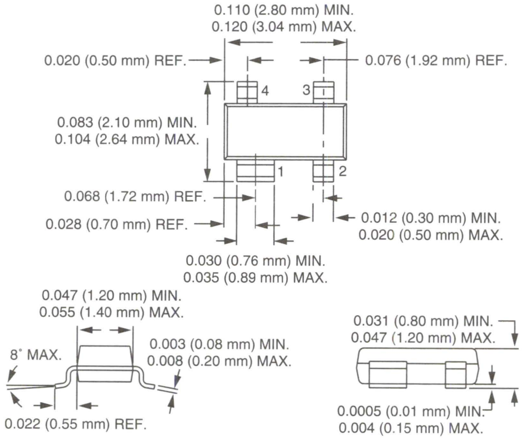
To achieve the effective 0.4 nH, the SOT-23 package must be inserted in the microstrip circuit board with a gap in the trace, as shown in the figure. Because of the polarity of the diode junction, this low inductance feature is only realizable with the cathode connected to ground.



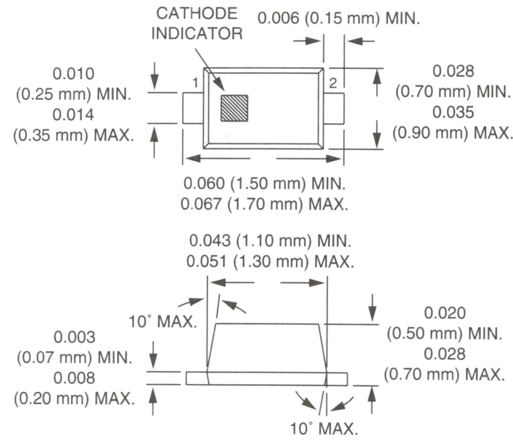
SC-70



SOT-143


0.110 (2.80 mm) MIN.
0.120 (3.04 mm) MAX.
0.020 (0.50 mm) REF.
0.076 (1.92 mm) REF.
4
3
0.083 (2.10 mm) MIN.
0.104 (2.64 mm) MAX.
1
2
0.068 (1.72 mm) REF.
0.028 (0.70 mm) REF.
0.012 (0.30 mm) MIN.
0.020 (0.50 mm) MAX.
0.030 (0.76 mm) MIN.
0.035 (0.89 mm) MAX.
0.047 (1.20 mm) MIN.
0.055 (1.40 mm) MAX.
8° MAX.
0.003 (0.08 mm) MIN.
0.008 (0.20 mm) MAX.
0.022 (0.55 mm) REF.
0.031 (0.80 mm) MIN.
0.047 (1.20 mm) MAX.
0.0005 (0.01 mm) MIN.
0.004 (0.15 mm) MAX.

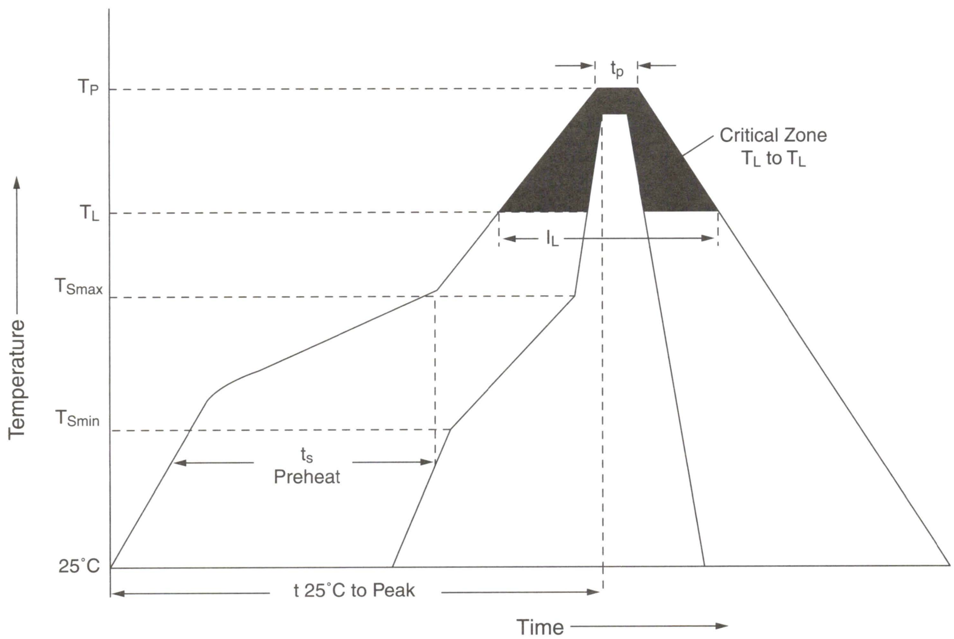
SC-79


CATHODE
INDICATOR
0.006 (0.15 mm) MIN.
0.010
(0.25 mm) MIN.
0.014
(0.35 mm) MAX.
1
2
0.028
(0.70 mm) MIN.
0.035
(0.90 mm) MAX.
0.060 (1.50 mm) MIN.
0.067 (1.70 mm) MAX.
0.043 (1.10 mm) MIN.
0.051 (1.30 mm) MAX.
10° MAX.
0.003
(0.07 mm) MIN.
0.008
(0.20 mm) MAX.
0.020
(0.50 mm) MIN.
0.028
(0.70 mm) MAX.
10° MAX.

Recommended Solder Reflow Profiles

Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average Ramp-Up Rate (T_L to T_P)	3°C/Second Max.	3°C/Second Max.
Preheat Temperature Min. (T_{Smin}) Temperature Max. (T_{Smax}) Time (Min. to Max.) (ts)	 100°C 150°C 60–120 Seconds	 150°C 200°C 60–80 Seconds
T_{Smax} to T_L Ramp-up Rate	—	3°C/Second Max.
Time Maintained Above: Temperature (T_L) Time (t_L)	 183°C 60–150 Seconds	 217°C 60–150 Seconds
Peak Temperature (T_P)	240 +0/-5°C	250 +0/-5°C
Time Within 5°C of Actual Peak Temperature (tp)	10–30 Seconds	20–40 Seconds
Ramp-Down Rate	6°C/Second Max.	6°C/Second Max.
Time 25°C to Peak Temperature	6 Minutes Max.	8 Minutes Max.

All temperatures refer to the topside of the package, measured on the package body surface.
Reference JEDEC J-STD-020B.



Reference JEDEC J-STD-020

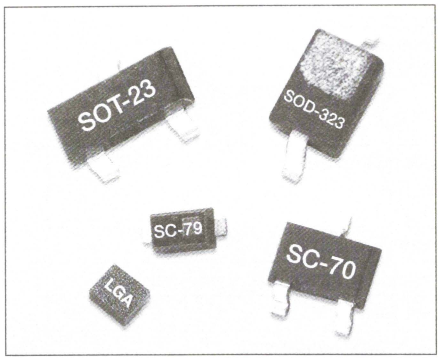
Low Capacitance Plastic Packaged PIN Diodes

SKYWORKS

SMP1321 Series

Features

- Designed for High Performance Wireless Switch Applications
- 0.25 pF Capacitance Specified
- Available Lead (Pb)-Free MSL-1 @ 250°C per JEDEC J-STD-020
- Available in Tape and Reel Packaging



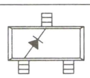
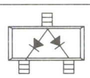
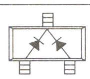
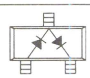
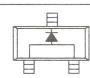
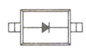
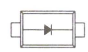
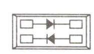
Description

The SMP1321 series of plastic packaged, surface mountable PIN diodes are designed for high volume switch applications from 10 MHz to beyond 2 GHz. The low capacitance of these diodes (0.25 pF) combined with its low resistance (2.0 Ω maximum at 10 mA) make the SMP1321 series particularly suited to high isolation series connected PIN diode switches in battery operated circuits. Available in a selection of plastic packages and in a variety of configurations including a low inductance (0.4 nH) SOT-23 (SMP1321-007), the small footprint SC-79 and the miniature SC-70. The SMP1321-508 has been specifically designed for WLAN 802.11 a, b, and g applications.

NEW Lead (Pb)-Free "environmentally friendly" packaging available: Skyworks offers the SMP1321-079LF and SMP1321-508 Lead (Pb)-Free package as a green alternative.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	100 V
Power Dissipation @ 25°C Lead Temperature (P_D)	250 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
ESD Human Body Model	Class 1B

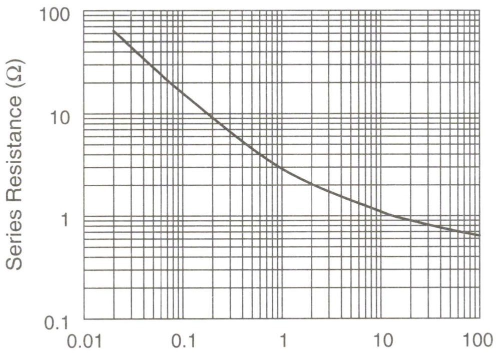
							
Single	Common Anode	Common Cathode	Series Pair	Low Inductance	Single	Single	Anti-Parallel
Marking: PM1	Marking: PM9	Marking: PM3	Marking: PM2	Marking: PMB			Marking: H
SOT-23	SOT-23	SOT-23	SOT-23	SOT-23	SOD-323	SC-79	LGA
SMP1321-001	**SMP1321-003**	**SMP1321-004**	**SMP1321-005**	**SMP1321-007**	**SMP1321-011**	**SMP1321-079**	**SMP1321-508**
L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 0.4 nH	L_S = 1.5 nH	L_S = 0.7 nH	L_S = 0.6 nH
	SC-70	SC-70	SC-70			SC-79	
	SMP1321-073	**SMP1321-074**	**SMP1321-075**			**SMP1321-079LF**	
	L_S = 1.4 nH	L_S = 1.4 nH	L_S = 1.4 nH			L_S = 0.7 nH	

LF denotes Lead (Pb)-Free packaging.

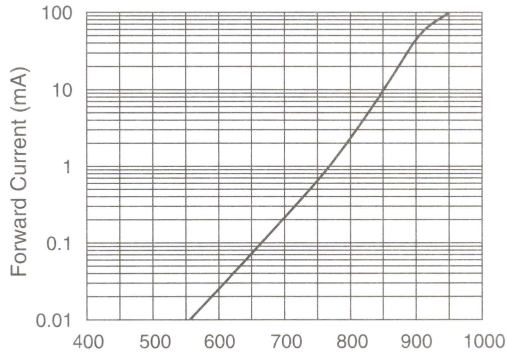
Electrical Specifications at 25°C

Parameter	Condition	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 100 V		10	µA
Capacitance (C_T)	F = 1 MHz, V = 30 V		0.25	pF
Resistance (R_S)	F = 100 MHz, I = 1 mA	3.0		Ω
Resistance (R_S)	F = 100 MHz, I = 10 mA		2.0	Ω
Forward Voltage (V_F)	IF = 10 mA	0.85		V
Carrier Lifetime (TI)	IF = 10 mA	0.4		µS
I Region Width		15		µm

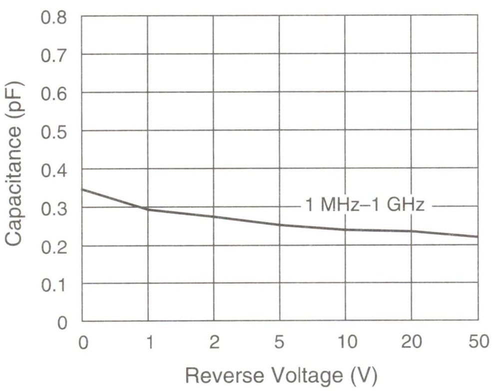
Typical Performance Data



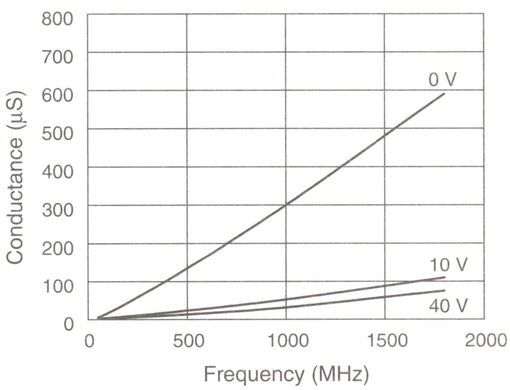
Series Resistance vs. Current @ 100 MHz



DC Characteristic



Capacitance vs. Reverse Voltage



Conductance vs. Frequency and Reverse Voltage

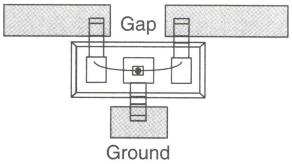
Resistance vs. Temperature @ 500 MHz

I_F (mA)	R -55°C (Ω)	R -15°C (Ω)	R +25°C (Ω)	R +65°C (Ω)	R +100°C (Ω)
0.02	47.400	50.000	56.300	61.500	65.100
0.10	12.000	12.600	13.900	15.400	16.400
0.30	5.200	5.400	5.800	6.400	6.900
0.50	3.600	3.800	4.100	4.500	4.800
1.00	2.400	2.500	2.600	2.800	3.100
10.00	1.030	1.040	1.040	1.070	1.150
20.00	0.871	0.888	0.873	0.889	0.956
100.00	0.669	0.659	0.642	0.645	0.695

SMP1321-007

In the -007 configuration of the SOT-23 package, the package inductance is effectively reduced to 0.4 nH, in comparison to the 1.5 nH value of the standard configuration. This lower inductance will be particularly beneficial when the diodes are used as shunt connected switches at frequencies higher than 500 MHz, where inductance is the primary limitation on maximum switch isolation.

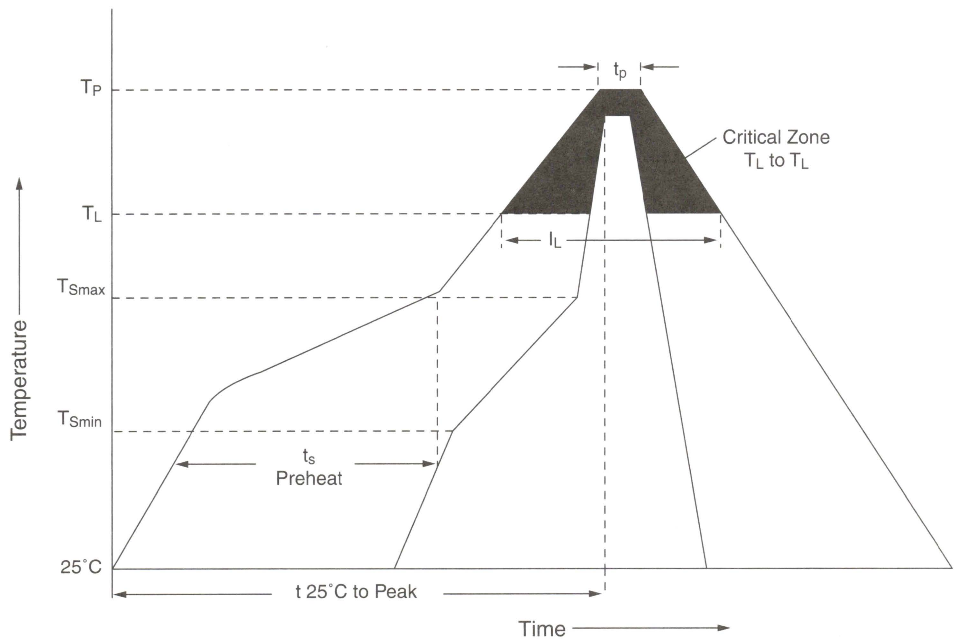
To achieve the effective 0.4 nH, the SOT-23 package must be inserted in the microstrip circuit board with a gap in the trace, as shown in the figure. Because of the polarity of the diode junction, this low inductance feature is only realizable with the cathode connected to ground.



Recommended Solder Reflow Profiles

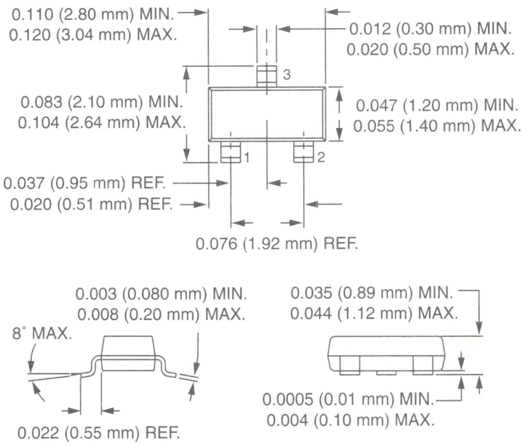
Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average Ramp-Up Rate (T_L to T_P)	3°C/Second Max.	3°C/Second Max.
Preheat Temperature Min. (T_{Smin}) Temperature Max. (T_{Smax}) Time (Min. to Max.) (ts)	 100°C 150°C 60–120 Seconds	 150°C 200°C 60–80 Seconds
T_{Smax} to T_L Ramp-up Rate	—	3°C/Second Max.
Time Maintained Above: Temperature (T_L) Time (t_L)	 183°C 60–150 Seconds	 217°C 60–150 Seconds
Peak Temperature (T_P)	240 +0/-5°C	250 +0/-5°C
Time Within 5°C of Actual Peak Temperature (tp)	10–30 Seconds	20–40 Seconds
Ramp-Down Rate	6°C/Second Max.	6°C/Second Max.
Time 25°C to Peak Temperature	6 Minutes Max.	8 Minutes Max.

All temperatures refer to the topside of the package, measured on the package body surface.
Reference JEDEC J-STD-020B.

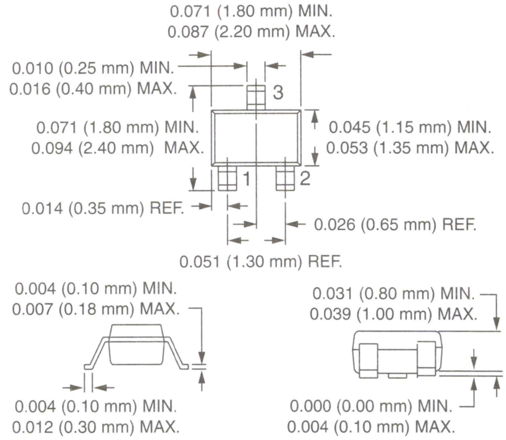


Reference JEDEC J-STD-020

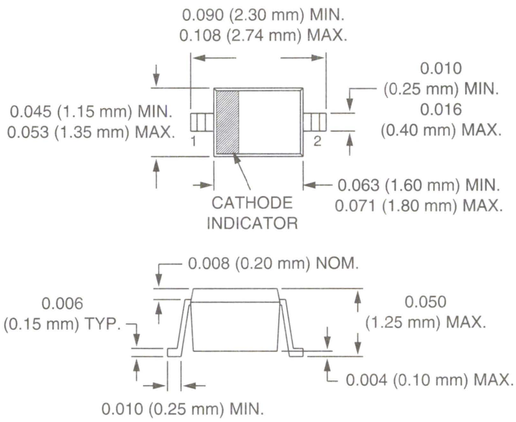
SOT-23



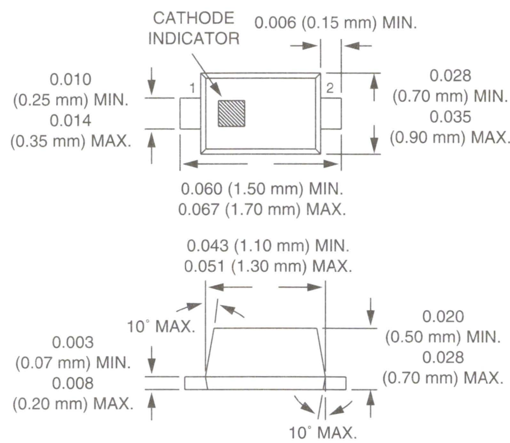
SC-70



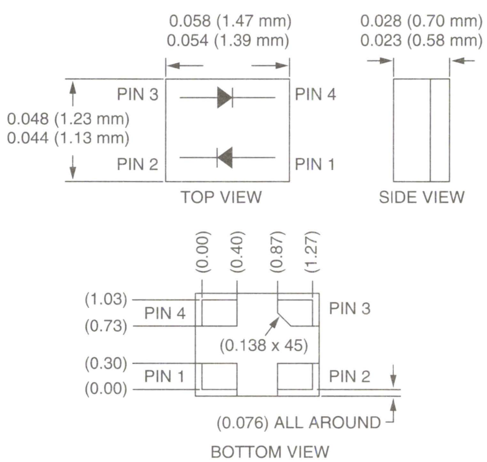
SOD-323



SC-79



LGA



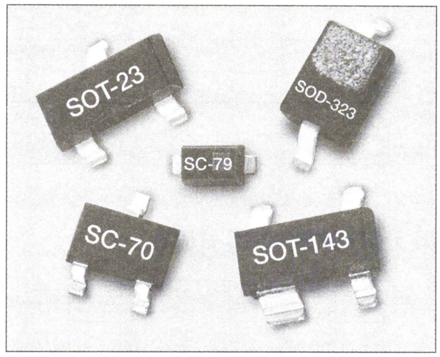
Low Resistance
Plastic Packaged PIN Diodes

SKYWORKS

SMP1322 Series

Features

- Designed for High Performance Wireless Switch Applications
- R_S @ 1 mA 0.8 Ω Typical
- Available Lead (Pb)-Free MSL-1 @ 250°C per JEDEC J-STD-020
- Available in Tape and Reel Packaging



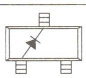
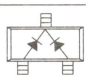
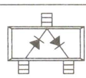
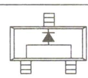
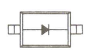
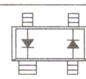
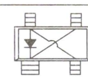
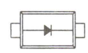
Description

The SMP1322 series of plastic packaged, surface mountable PIN diodes are designed for high volume switch applications from 10 MHz to beyond 2 GHz. The ultra low resistance of these diodes (1.5 Ω maximum at 1 mA and 0.5 Ω typical at 10 mA) make the SMP1322 series particularly suited to low loss PIN diode switches in battery operated circuits. Available in a selection of plastic packages and in a variety of configurations including an ultra low inductance (0.2 nH) SOT-143 (SMP1322-017), the small footprint SC-79 and the miniature SC-70. In addition, the SMP1322-016 consists of 2 diodes in a SOT-143 package configured to enable insertion in a quarter-wave T/R switch with no crossover connections.

NEW Lead (Pb)-Free "environmentally friendly" packaging available: Skyworks offers the SMP-1322-079LF Lead (Pb)-Free package as a green alternative.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	50 V
Power Dissipation @ 25°C Lead Temperature (P_D)	250 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
ESD Human Body Model	Class 1B

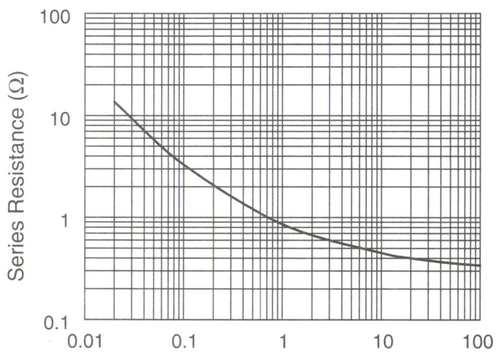
							
Single	Common Cathode	Series Pair	Low Inductance	Single	T/R Switch	Ultra Low Inductance	Single
Marking: PN1	Marking: PN3	Marking: PN2	Marking: PNB		Marking: PN6	Marking: PNF	
SOT-23	SOT-23	SOT-23	SOT-23	SOD-323	SOT-143	SOT-143	SC-79
SMP1322-001	**SMP1322-004**	**SMP1322-005**	**SMP1322-007**	**SMP1322-011**	**SMP1322-016**	**SMP1322-017**	**SMP1322-079**
L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 0.4 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 0.2 nH	L_S = 0.7 nH
	SC-70	SC-70					SC-79
	SMP1322-074	**SMP1322-075**					**SMP1322-079LF**
	L_S = 1.4 nH	L_S = 1.4 nH					L_S = 0.7 nH

LF denotes Lead (Pb)-Free packaging.

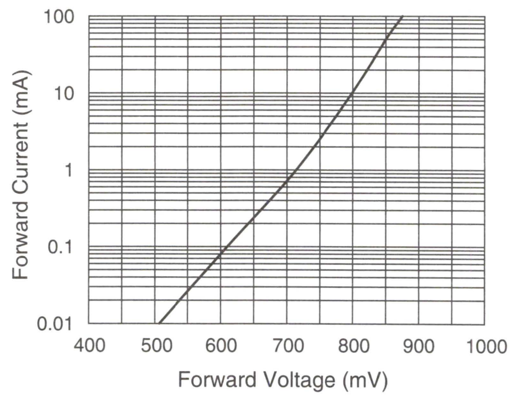
Electrical Specifications at 25°C

Parameter	Condition	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 50 V		10	µA
Capacitance (C_T)	F = 1 MHz, V = 30 V		1.0	pF
Resistance (R_S)	F = 100 MHz, I = 1 mA		1.5	Ω
Resistance (R_S)	F = 100 MHz, I = 10 mA	0.5		Ω
Forward Voltage (V_F)	IF = 10 mA	0.85		V
Carrier Lifetime (TI)	IF = 10 mA	0.4		µS
I Region Width		8		µm

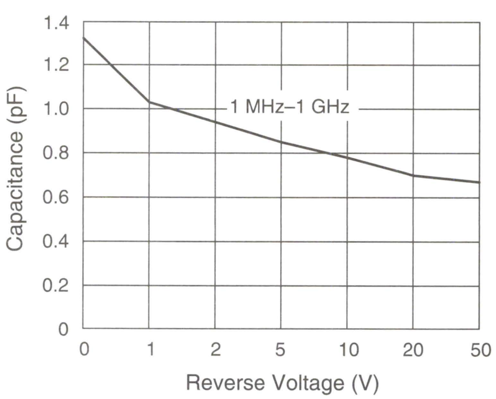
Typical Performance Data



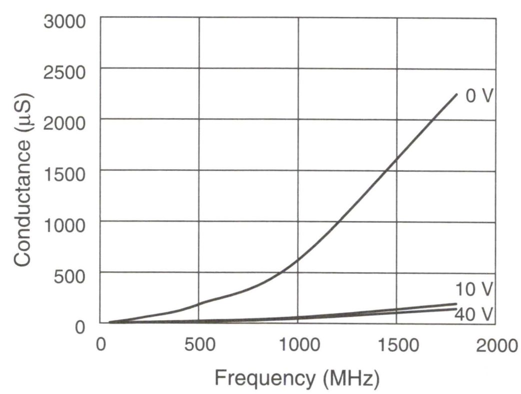
Series Resistance vs. Current @ 100 MHz



DC Characteristic



Capacitance vs. Reverse Voltage



Conductance vs. Frequency and Reverse Voltage

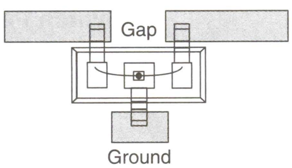
Resistance vs. Temperature @ 500 MHz

I_F (mA)	R -55°C (Ω)	R -15°C (Ω)	R +25°C (Ω)	R +65°C (Ω)	R +100°C (Ω)
0.02	9.500	9.400	9.900	10.500	10.900
0.10	3.000	3.000	3.000	3.300	3.500
0.30	1.500	1.500	1.500	1.600	1.800
0.50	1.100	1.100	1.200	1.200	1.400
1.00	0.922	0.914	0.902	0.963	1.100
10.00	0.568	0.559	0.533	0.563	0.655
20.00	0.532	0.520	0.494	0.521	0.610
100.00	0.483	0.469	0.440	0.464	0.565

SMP1322-007

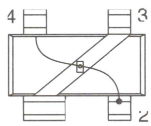
In the -007 configuration of the SOT-23 package, the package inductance is effectively reduced to 0.4 nH, in comparison to the 1.5 nH value of the standard configuration. This lower inductance will be particularly beneficial when the diodes are used as shunt connected switches at frequencies higher than 500 MHz, where inductance is the primary limitation on maximum switch isolation.

To achieve the effective 0.4 nH, the SOT-23 package must be inserted in the microstrip circuit board with a gap in the trace, as shown in the figure. Because of the polarity of the diode junction, this low inductance feature is only realizable with the cathode connected to ground.

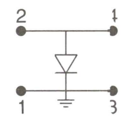


SMP1322-017 SOT-143 Low Inductance PIN Diode

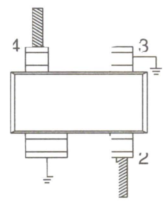
The SMP1322-017 utilizes the SMP1322 PIN diode chip in a customized SOT-143 plastic package designed for high isolation performance in a shunt connected switch. Its effective inductance, based on the 3 GHz isolation, is less than 0.2 nH. This diode is designed to work effectively as a shunt element in SPDT switches, covering the wireless frequencies from 900 MHz to beyond 2 GHz. Excellent performance is achievable when used in a quarter-wave T/R switch with the SMP1322-001 (SOT-23) or SMP1322-011 (SOD-323) PIN diode as the series connected diode.



Lead Configuration



Schematic

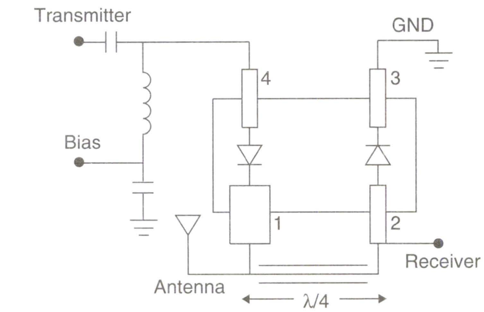


Switch Connection

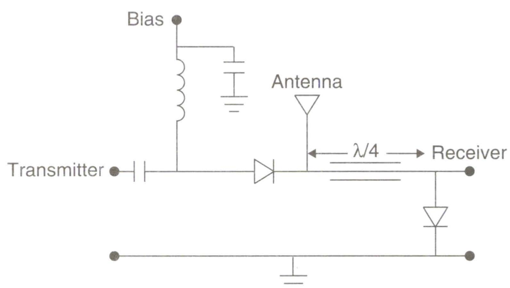
SMP1322-016 SOT-143 T/R Switch

The SMP1322-016 is a low cost PIN diode unconnected pair specifically designed for low current drain antenna T/R switches in hand held wireless suits. In the specifically configured SOT-143 package, the PIN diodes are oriented to enable connection as a λ/4 switch with no external crossover connections.

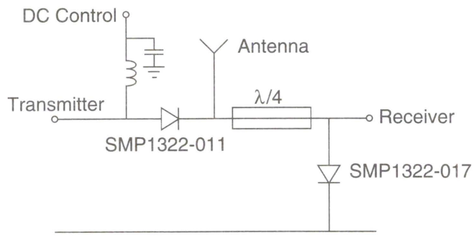
SMP1322-016 in λ/4 T/R Switch

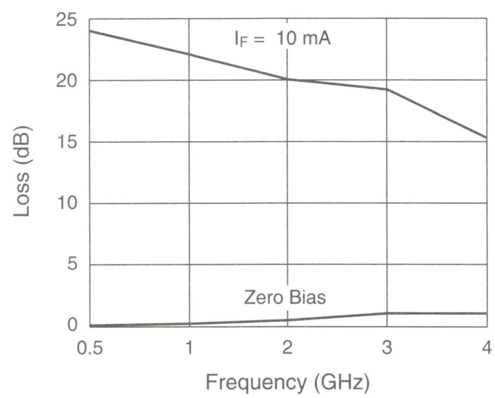


λ/4 T/R Switch



T/R Switch Design



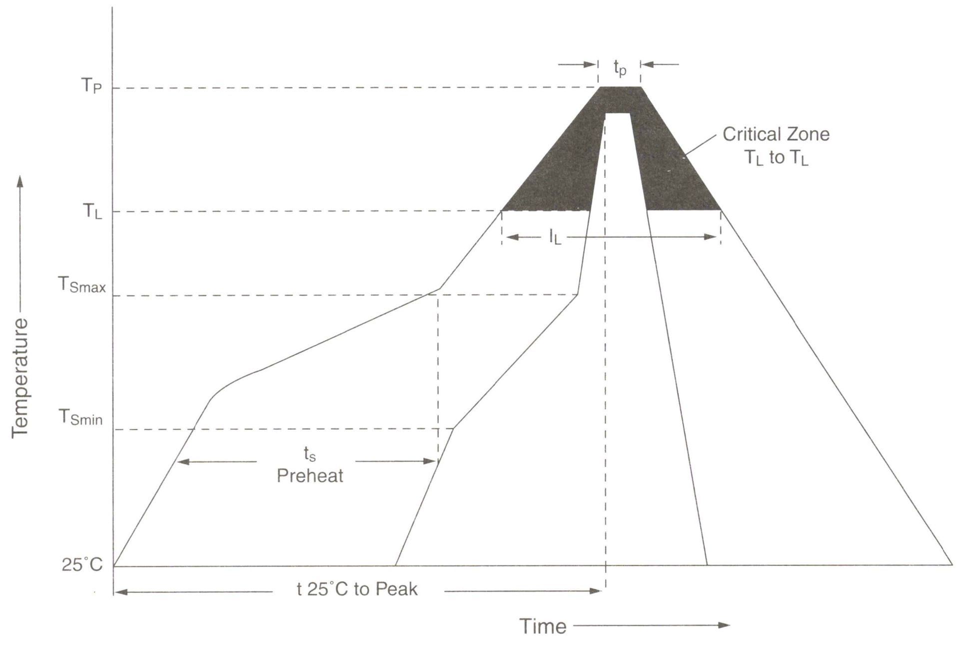


SMP1322-017 Typical SPST Switch Performance

Recommended Solder Reflow Profiles

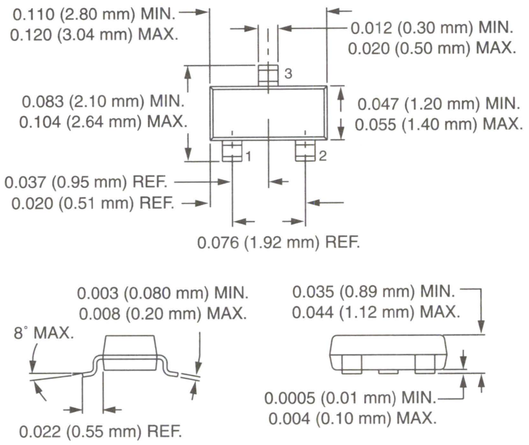
Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average Ramp-Up Rate (T_L to T_P)	3°C/Second Max.	3°C/Second Max.
Preheat Temperature Min. (T_{Smin}) Temperature Max. (T_{Smax}) Time (Min. to Max.) (ts)	 100°C 150°C 60–120 Seconds	 150°C 200°C 60–80 Seconds
T_{Smax} to T_L Ramp-up Rate	—	3°C/Second Max.
Time Maintained Above: Temperature (T_L) Time (t_L)	 183°C 60–150 Seconds	 217°C 60–150 Seconds
Peak Temperature (T_P)	240 +0/-5°C	250 +0/-5°C
Time Within 5°C of Actual Peak Temperature (tp)	10–30 Seconds	20–40 Seconds
Ramp-Down Rate	6°C/Second Max.	6°C/Second Max.
Time 25°C to Peak Temperature	6 Minutes Max.	8 Minutes Max.

All temperatures refer to the topside of the package, measured on the package body surface.
Reference JEDEC J-STD-020B.

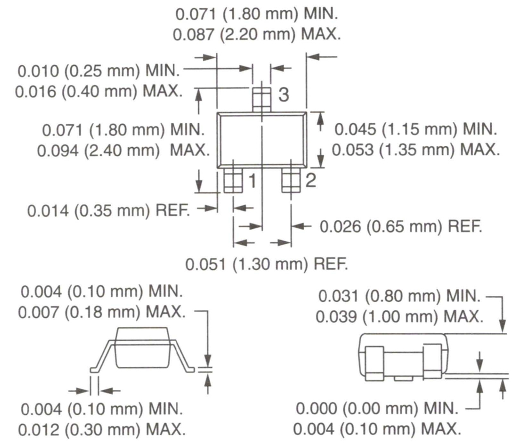


Reference JEDEC J-STD-020

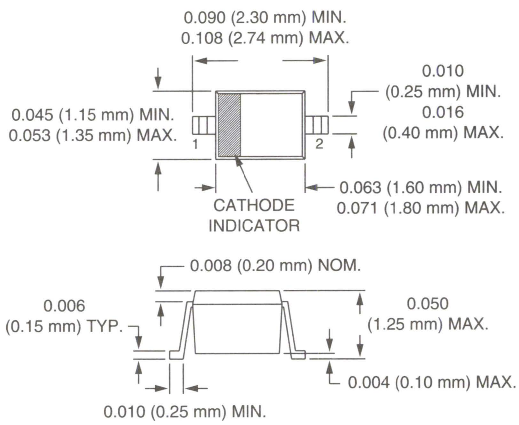
SOT-23



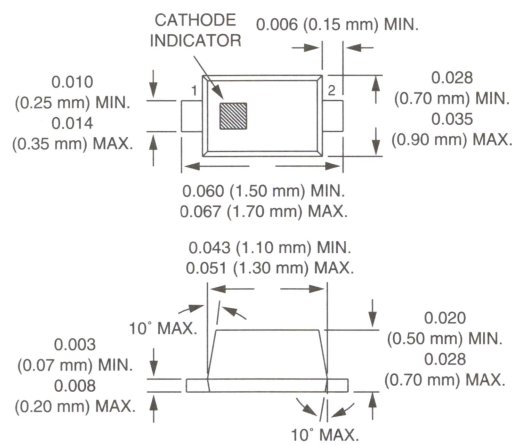
SC-70



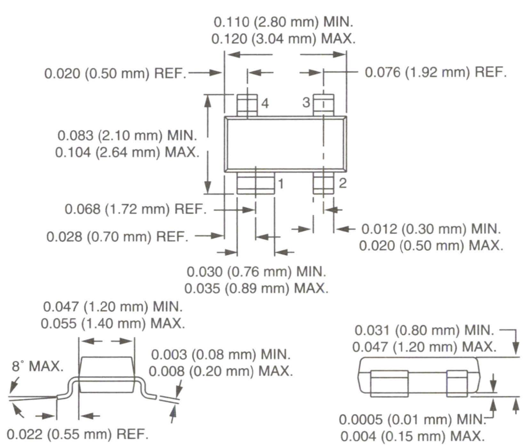
SOD-323



SC-79



SOT-143



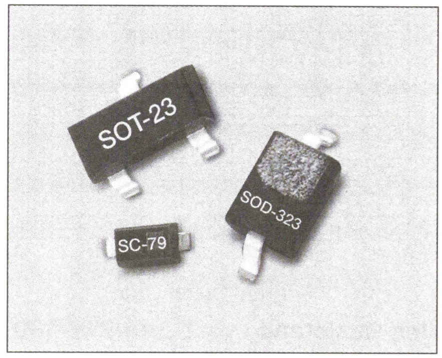
Large Signal Switching Plastic Packaged PIN Diodes

SKYWORKS

SMP1352 Series

Features

- Designed for Large Signal Switches In Base Station and Handset Applications
- Available Lead (Pb)-Free MSL-1 @ 250°C per JEDEC J-STD-020
- Available in Tape and Reel Packaging



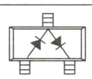
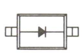
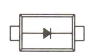
Description

The SMP1352 series of plastic packaged, surface mountable, low capacitance (0.3 pF) silicon PIN diodes are designed for large signal switch applications from 10 MHz to beyond 2 GHz. These diodes have a reverse voltage rating of 200 V and are designed for use in low distortion switches that are required to hold off large RF voltages. The nominal 50 μm I region width, combined with the typical 1.5 μS carrier lifetime, results in a PIN diode with low forward resistance and low distortion characteristics.

NEW Lead (Pb)-Free "environmentally friendly" packaging available: Skyworks offers the SMP1352-079LF Lead (Pb)-Free package as a green alternative.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	200 V
Power Dissipation @ 25°C Lead Temperature (P_D)	250 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
ESD Human Body Model	Class 1C

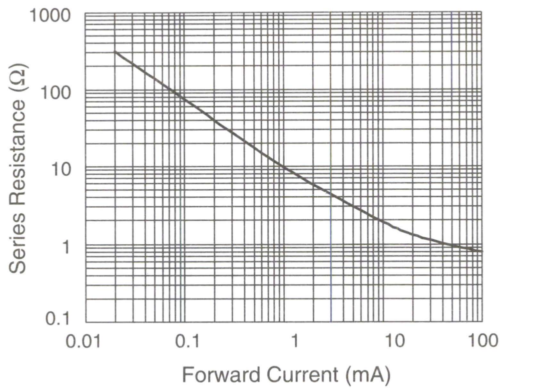
		
Series Pair	Single	Single
Marking: PR2		
SOT-23	SOD-323	SC-79
SMP1352-005	**SMP1352-011**	**SMP1352-079**
		SMP1352-079LF
L_S = 1.5 nH	L_S = 1.5 nH	L_S = 0.7 nH

LF denotes Lead (Pb)-Free packaging.

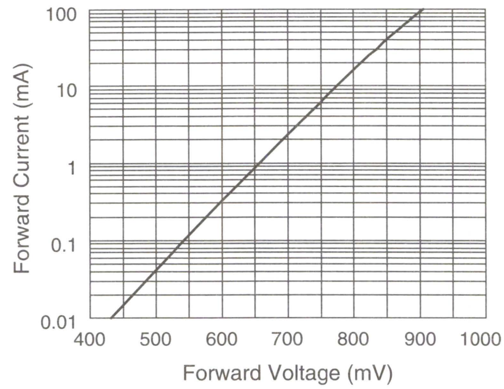
Electrical Specifications at 25°C

Parameter	Condition	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 200 V		10	μA
Capacitance (C_T)	F = 1 MHz, V = 20 V		0.35	pF
Resistance (R_S)	F = 100 MHz, I = 1 mA	11.0	15.0	Ω
Resistance (R_S)	F = 100 MHz, I = 10 mA	2.0	2.8	Ω
Resistance (R_S)	F = 100 MHz, I = 100 mA	1.0	1.35	Ω
Forward Voltage (V_F)	IF = 10 mA	0.80		V
Carrier Lifetime (TI)	IF = 10 mA	1.0		μS
I Region Width		50		μm

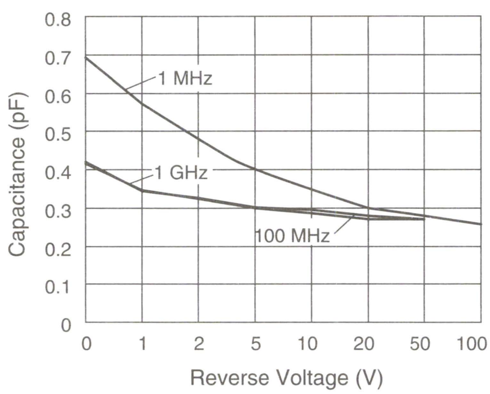
Typical Performance Data



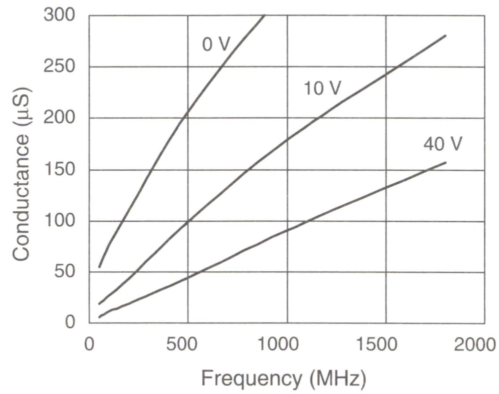
Series Resistance vs. Current @ 100 MHz



DC Characteristic



Capacitance vs. Reverse Voltage



Conductance vs. Frequency and Reverse Voltage

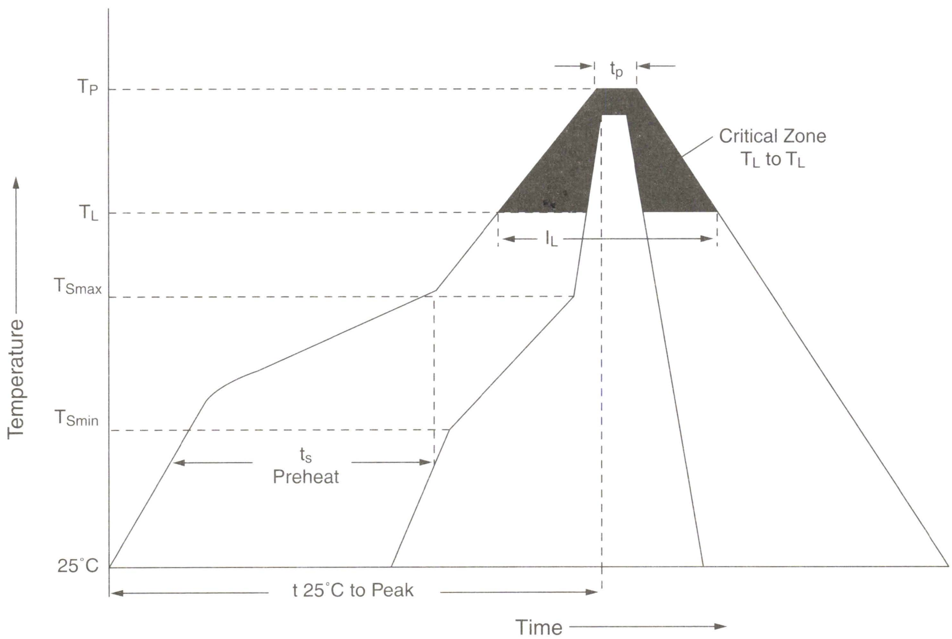
Resistance vs. Temperature @ 100 MHz

I_F (mA)	R -55°C (Ω)	R -15°C (Ω)	R +25°C (Ω)	R +65°C (Ω)	R +100°C (Ω)
0.02	260.00	276.00	302.00	263.00	240.00
0.10	60.90	64.00	70.60	71.00	70.10
0.30	22.40	23.60	26.00	27.80	28.20
1.00	7.90	8.50	9.20	10.30	10.70
10.00	1.50	1.70	1.90	2.20	2.30
20.00	1.10	1.20	1.30	1.60	1.70
100.00	0.55	0.69	0.78	0.98	1.03

Recommended Solder Reflow Profiles

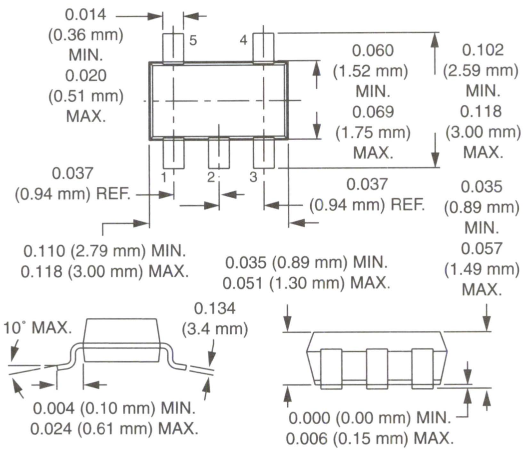
Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average Ramp-Up Rate (T_L to T_P)	3°C/Second Max.	3°C/Second Max.
Preheat Temperature Min. (T_{Smin}) Temperature Max. (T_{Smax}) Time (Min. to Max.) (ts)	 100°C 150°C 60–120 Seconds	 150°C 200°C 60–80 Seconds
T_{Smax} to T_L Ramp-up Rate	—	3°C/Second Max.
Time Maintained Above: Temperature (T_L) Time (t_L)	 183°C 60–150 Seconds	 217°C 60–150 Seconds
Peak Temperature (T_P)	240 +0/-5°C	250 +0/-5°C
Time Within 5°C of Actual Peak Temperature (tp)	10–30 Seconds	20–40 Seconds
Ramp-Down Rate	6°C/Second Max.	6°C/Second Max.
Time 25°C to Peak Temperature	6 Minutes Max.	8 Minutes Max.

All temperatures refer to the topside of the package, measured on the package body surface.
Reference JEDEC J-STD-020B.

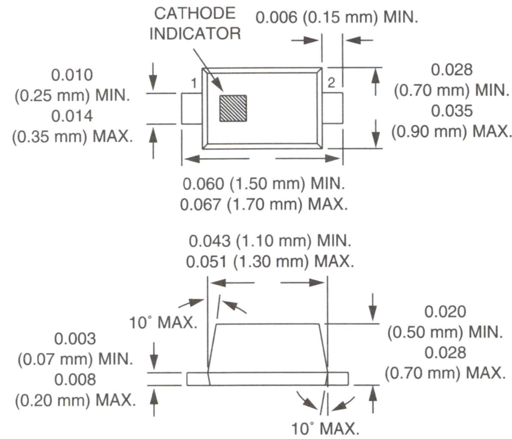


Reference JEDEC J-STD-020

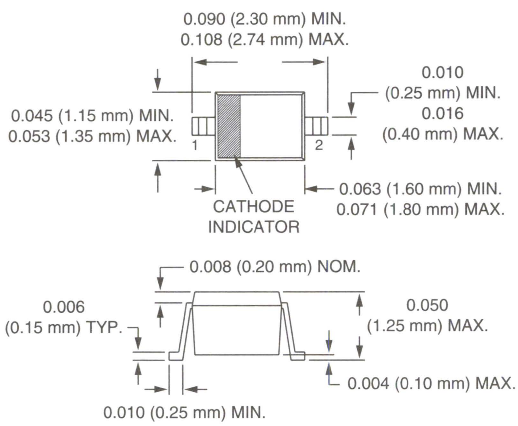
SOT-23



SC-79



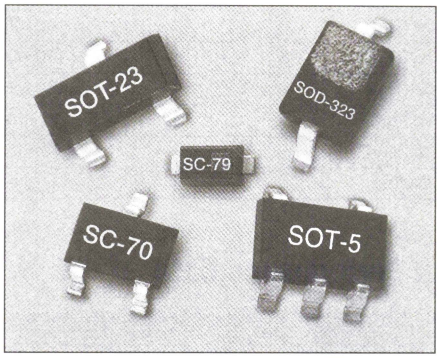
SOD-323



Switch and Attenuator Plastic Packaged PIN Diodes

SKYWORKS

SMP1302 Series



Features

- Designed for Base Station and Handset Applications
- Low Distortion Design
- Available Lead (Pb)-Free MSL-1 @ 250°C per JEDEC J-STD-020
- Available in Tape and Reel Packaging

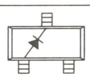
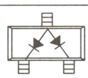
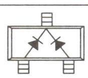
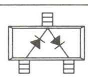
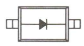
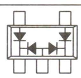
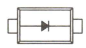
Description

The SMP1302 series of plastic packaged, surface mountable, low capacitance (0.3 pF) silicon PIN diodes are designed for high volume switch and attenuator applications from 10 MHz to beyond 2 GHz. These diodes are designed for use in low distortion PI and TEE attenuators with low drive current (maximum resistance at 1 mA is 10 Ω) commonly used in TV distribution and cellular base station applications. The nominal 50 μm I region width combined with a maximum resistance of 3 Ω at 10 mA, make these diodes useful in large signal switch applications. Available as single and dual diodes in a selection of plastic packages including SOT-23, SOD-323, small footprint SC-79 and miniature SC-70. Available in a SOT-5 (SMP1302-027) package as a four diode array designed for insertion in the commonly used 4 diode PI attenuator circuit.

NEW Lead (Pb)-Free "environmentally friendly" packaging available: Skyworks offers the SMP1302-079LF Lead (Pb)-Free package as a green alternative.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	200 V
Power Dissipation @ 25°C Lead Temperature (P_D)	250 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
ESD Human Body Model	Class 1C

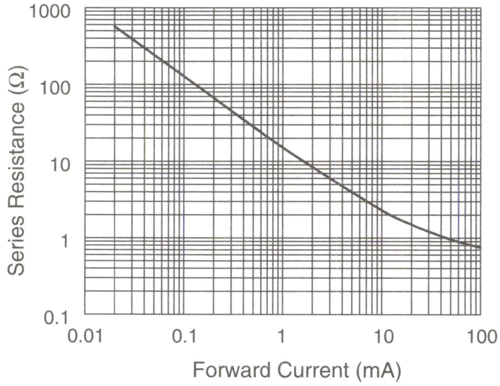
						
Single	Common Anode	Common Cathode	Series Pair	Single	PI	Single
Marking: PF1	Marking: PF9	Marking: PF3	Marking: PF2		Marking: PFM	
SOT-23	SOT-23	SOT-23	SOT-23	SOD-323	SOT-5	SC-79
SMP1302-001	**SMP1302-003**	**SMP1302-004**	**SMP1302-005**	**SMP1302-011**	**SMP1302-027**	**SMP1302-079**
L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH		L_S = 0.7 nH
	SC-70	SC-70	SC-70			SC-79
	SMP1302-073	**SMP1302-074**	**SMP1302-075**			**SMV1302-079LF**
	L_S = 1.4 nH	L_S = 1.4 nH	L_S = 1.4 nH			L_S = 0.7 nH

LF denotes Lead (Pb)-Free packaging.

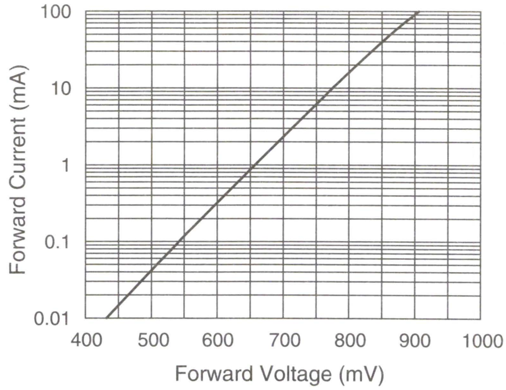
Electrical Specifications at 25°C

Parameter	Condition	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 200 V		10	µA
Capacitance (C_T)	F = 1 MHz, V = 30 V		0.30	pF
Resistance (R_S)	F = 100 MHz, I = 1 mA	15	20	Ω
Resistance (R_S)	F = 100 MHz, I = 10 mA		3.0	Ω
Resistance (R_S)	F = 100 MHz, I = 100 mA		1.5	Ω
Forward Voltage (V_F)	IF = 10 mA	0.8		V
Carrier Lifetime (TI)	IF = 10 mA	0.7		µS
I Region Width		50		µm

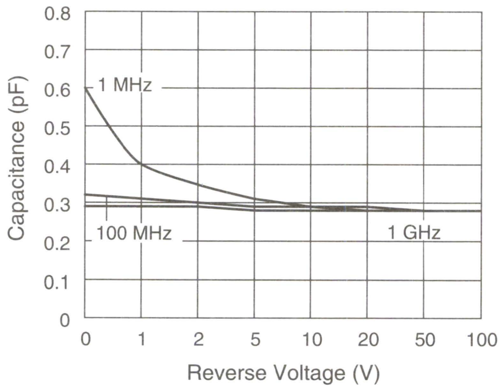
Typical Performance Data



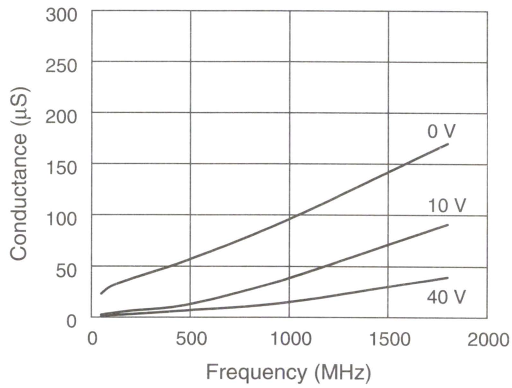
Series Resistance vs. Current @ 100 MHz



DC Characteristic



Capacitance vs. Reverse Voltage

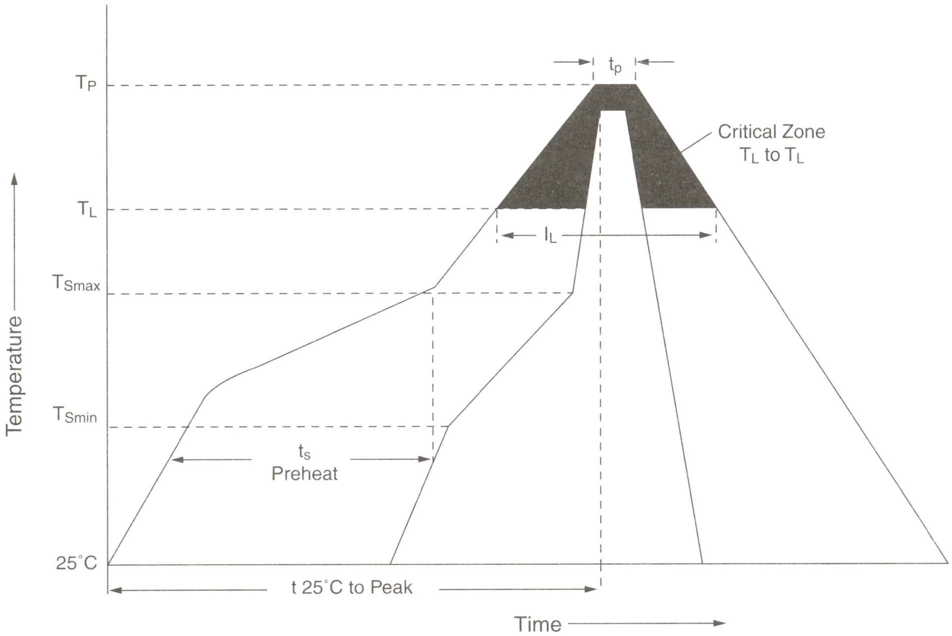


Conductance vs. Frequency and Reverse Voltage

Recommended Solder Reflow Profiles

Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average Ramp-Up Rate (T_L to T_P)	3°C/Second Max.	3°C/Second Max.
Preheat Temperature Min. (T_{Smin}) Temperature Max. (T_{Smax}) Time (Min. to Max.) (ts)	 100°C 150°C 60–120 Seconds	 150°C 200°C 60–80 Seconds
T_{Smax} to T_L Ramp-up Rate	—	3°C/Second Max.
Time Maintained Above: Temperature (T_L) Time (t_L)	 183°C 60–150 Seconds	 217°C 60–150 Seconds
Peak Temperature (T_P)	240 +0/-5°C	250 +0/-5°C
Time Within 5°C of Actual Peak Temperature (tp)	10–30 Seconds	20–40 Seconds
Ramp-Down Rate	6°C/Second Max.	6°C/Second Max.
Time 25°C to Peak Temperature	6 Minutes Max.	8 Minutes Max.

All temperatures refer to the topside of the package, measured on the package body surface.
Reference JEDEC J-STD-020B.

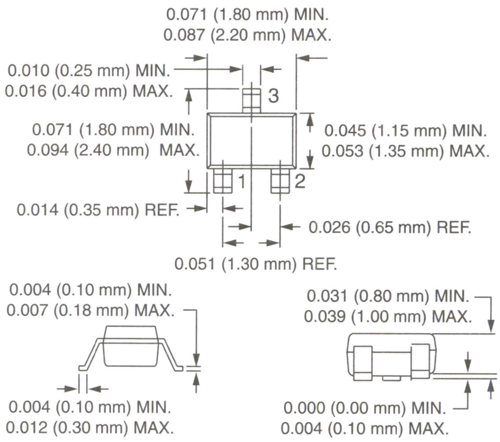


Reference JEDEC J-STD-020

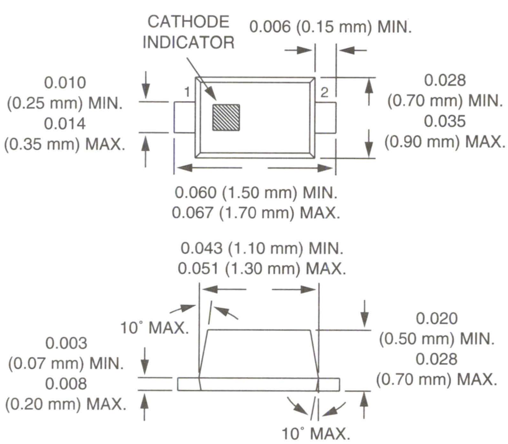
Resistance vs. Temperature @ 100 MHz

I_F (mA)	R -55°C (Ω)	R -15°C (Ω)	R +25°C (Ω)	R +65°C (Ω)	R +100°C (Ω)
	-55.00	-15.00	25.0	65.0	100.00
0.02	599.00	653.00	692.0	715.0	722.00
0.10	123.00	135.00	143.0	154.0	161.00
0.30	42.20	46.60	49.7	54.3	56.80
1.00	13.50	15.00	16.2	17.9	18.80
10.00	2.00	2.30	2.6	2.9.0	3.00
20.00	1.34	1.50	1.7	2.0	2.00
100.00	0.60	0.74	1.0	1.1	1.10

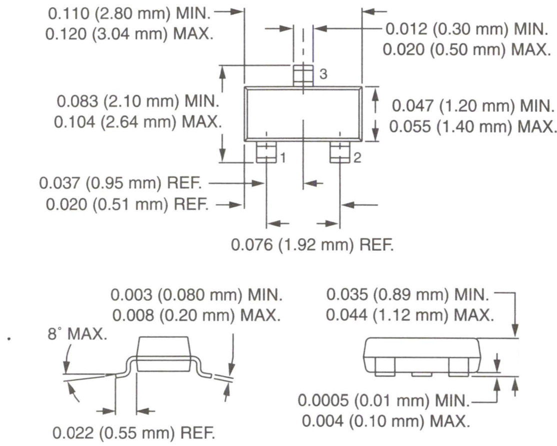
SC-70



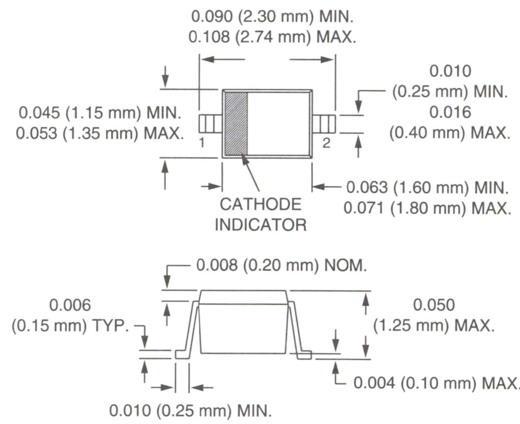
SC-79



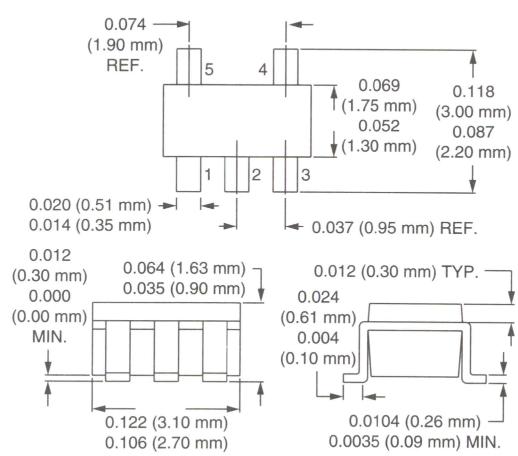
SOT-23



SOD-323



SOT-5



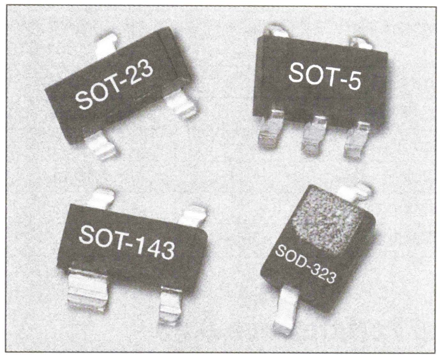
Low Distortion Attenuator Plastic Packaged PIN Diodes

SKYWORKS

SMP1304 Series

Features

- Low Distortion Design
- Frequency Range from HF to > 2 GHz
- Designed for Base Station Applications
- Configured for PI and TEE Attenuators

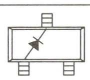
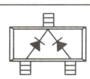
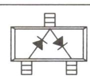
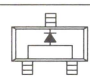
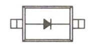
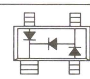
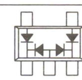


Description

The SMP1304 series of plastic packaged, surface mountable, low capacitance (0.3 pF) silicon PIN diodes are designed for use in attenuator applications from 5 MHz to beyond 2 GHz. The thick 100 μm I region of these PIN diodes makes them very attractive for use in low distortion PI and TEE attenuators commonly used in TV distribution applications. The 1 μS typical carrier lifetime of these diodes results in resistance of 20 Ω maximum at 1 mA and 7 Ω maximum at 10 mA. Available in a selection of plastic packages: as a single diode in the small footprint SOD-323 package and in a variety of configurations in the SOT-23 package, including a low inductance (0.4 nH) SMP1304-007 package. Also available in the SOT-143 package are three diode junctions designed for insertion in TEE attenuators (SMP1304-018) and PI attenuators (SMP1304-019). Also available in a SOT-5 (SMP1304-027) package as a four diode array designed for insertion in the commonly used 4 diode PI attenuator circuit.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	200 V
Power Dissipation @ 25°C Lead Temperature (P_D)	250 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
ESD Human Body Model	Class 1C

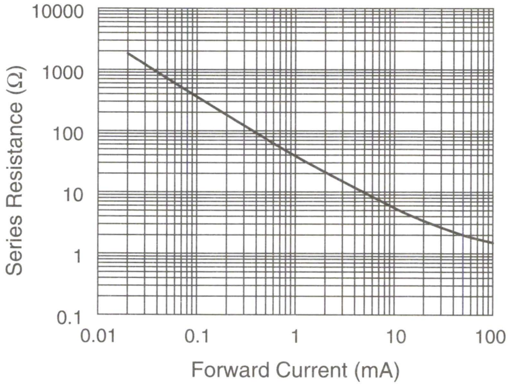
						
Single	Common Cathode	Series Pair	Low Inductance	Single	PI	PI
Marking: PG1	Marking: PG3	Marking: PG2	Marking: PGB		Marking: PGJ	Marking: PGM
SOT-23	SOT-23	SOT-23	SOT-23	SOD-323	SOT-143	SOT-5
♦ **SMP1304-001**	♦ **SMP1304-004**	♦ **SMP1304-005**	♦ **SMP1304-007**	♦ **SMP1304-011**	♦ **SMP1304-019**	♦ **SMP1304-027**
L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 0.4 nH	L_S = 1.5 nH		

♦ Available through distribution.

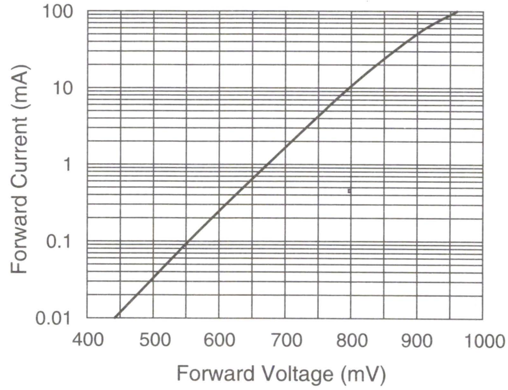
Electrical Specifications at 25°C

Parameter	Condition	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 200 V		10	µA
Capacitance (C_T)	F = 1 MHz, V = 30 V		0.30	pF
Capacitance (C_T)	F = 1 MHz, V = 30 V (SMP1304-018 & SMP1304-019)		0.45	pF
Resistance (R_S)	F = 100 MHz, I = 1 mA	40	50	Ω
Resistance (R_S)	F = 100 MHz, I = 10 mA		7.0	Ω
Resistance (R_S)	F = 100 MHz, I = 100 mA		2.0	Ω
Forward Voltage (V_F)	IF = 10 mA	0.8		V
Carrier Lifetime (TI)	IF = 10 mA	1.0		µS
I Region Width		100		µm

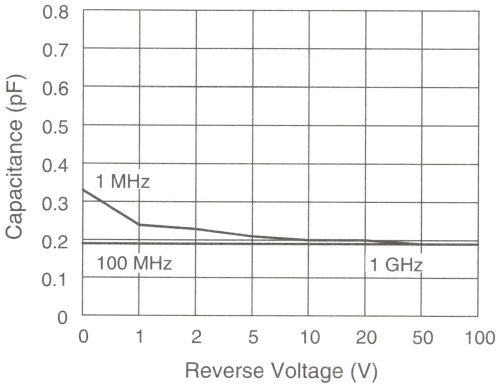
Typical Performance Data



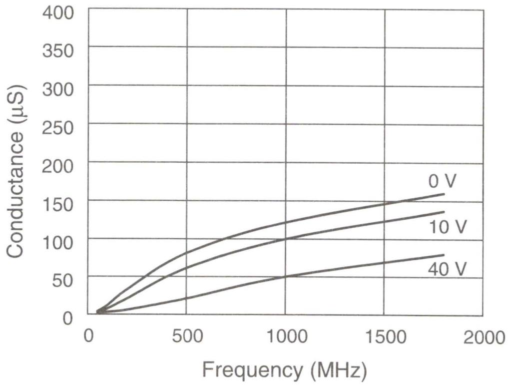
Series Resistance vs. Current @ 100 MHz



DC Characteristic



Capacitance vs. Reverse Voltage



Conductance vs. Frequency and Reverse Voltage

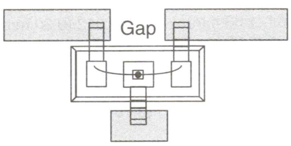
Resistance vs. Temperature @ 100 MHz

I_F (mA)	R -55°C (Ω)	R -15°C (Ω)	R +25°C (Ω)	R +65°C (Ω)	R +100°C (Ω)
0.02	1590.0	1660.0	1752.0	1770.0	1760.0
0.10	315.0	340.0	367.0	396.0	409.0
0.30	108.0	118.0	128.0	141.0	147.0
1.00	34.5	37.9	41.6	46.3	48.8
10.00	4.8	5.3	5.8	6.6	7.0
20.00	3.0	3.3	3.6	4.1	4.3
100.00	1.3	1.4	1.5	1.7	1.8

SMP1304-007

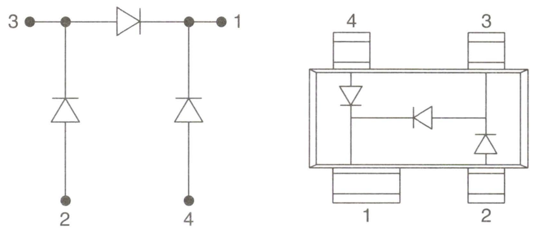
In the -007 configuration of the SOT-23 package, the package inductance is effectively reduced to 0.4 nH, in comparison to the 1.5 nH value of the standard configuration. This lower inductance will be particularly beneficial when the diodes are used as shunt connected switches at frequencies higher than 500 MHz, where inductance is the primary limitation on maximum switch isolation.

To achieve the effective 0.4 nH, the SOT-23 package must be inserted in the microstrip circuit board with a gap in the trace, as shown in the figure. Because of the polarity of the diode junction, this low inductance feature is only realizable with the cathode connected to ground.



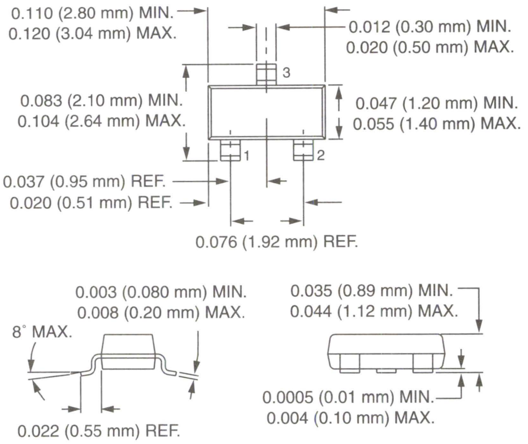
SMP1304-019 PI Attenuator PIN Diodes

The SMP1304-019 employ three PIN diode junctions in a SOT-143 package. They are configured for ease of insertion in PI attenuator circuits commonly used from 10 MHz to beyond 1 GHz. The SMP1304 PIN diode junction was designed for low capacitance, wide resistance dynamic range and low distortion performance.

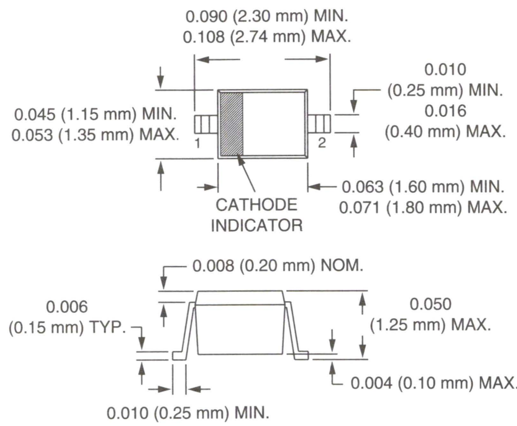


SMP1304-019 (PI)

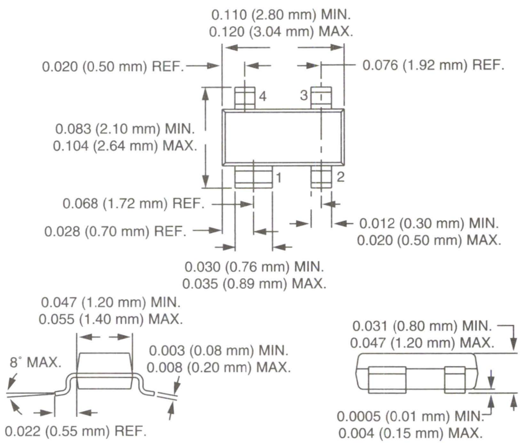
SOT-23



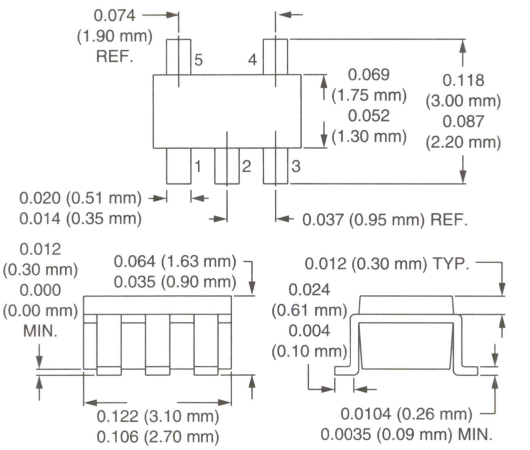
SOD-323



SOT-143



SOT-5



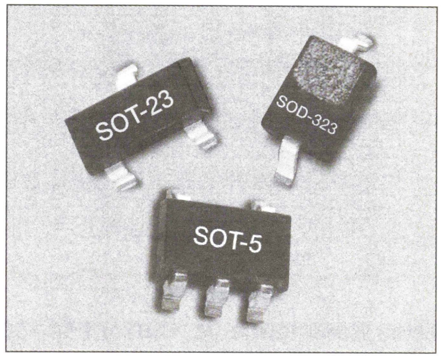
Very Low Distortion Attenuator Plastic Packaged PIN Diodes

SKYWORKS

SMP1307 Series

Features

- Low Distortion Design
- Frequency Range from HF to > 2 GHz
- Designed for CATV AGC Applications
- Designed for High Volume Wireless Applications

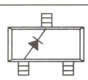
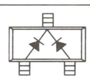
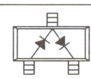
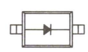
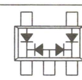


Description

The SMP1307 series of plastic packaged, surface mountable, low capacitance (0.3 pF) silicon PIN diodes are designed for use in attenuator applications from 5 MHz to beyond 2 GHz. The thick 175 μm I region of these PIN diodes makes them very attractive for use in very low distortion PI and TEE attenuators commonly used in TV distribution applications. The 1.5 μS typical carrier lifetime of these diodes results in resistance of 100 Ω maximum at 1 mA and 10 Ω maximum at 10 mA. Available in a selection of plastic packages, as a single diode in the small footprint SOD-323, and in a variety of configurations in the SOT-23. Also available in a SOT-5 (SMP1307-027) package as a four diode array designed for insertion in the commonly used 4 diode PI attenuator circuit.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	200 V
Power Dissipation @ 25°C Lead Temperature (P_D)	250 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
ESD Human Body Model	Class 1C

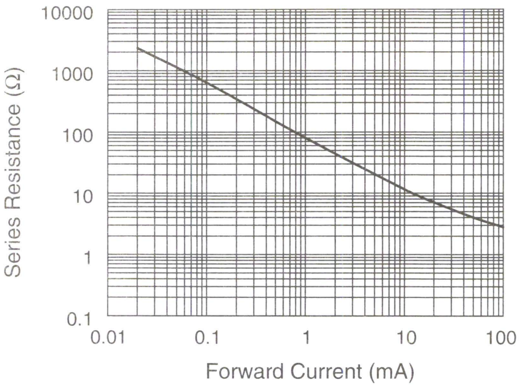
				
Single	Common Cathode	Series Pair	Single	PI
Marking: PJ1	Marking: PJ3	Marking: PJ2		Marking: PJM
SOT-23	SOT-23	SOT-23	SOD-323	SOT-5
♦ **SMP1307-001**	♦ **SMP1307-004**	♦ **SMP1307-005**	♦ **SMP1307-011**	♦ **SMP1307-027**
L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	

♦ Available through distribution.

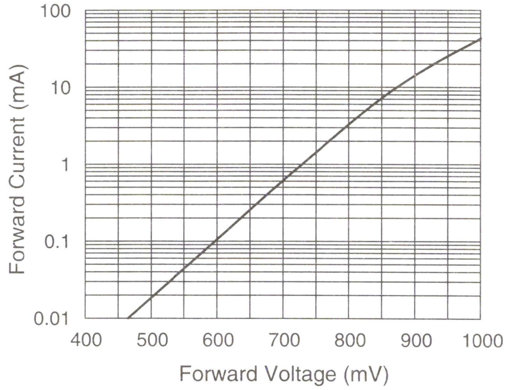
Electrical Specifications at 25°C

Parameter	Condition	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 200 V		10	μA
Capacitance (C_T)	F = 1 MHz, V = 30 V		0.30	pF
Resistance (R_S)	F = 100 MHz, I = 1 mA	75	100	Ω
Resistance (R_S)	F = 100 MHz, I = 10 mA		15	Ω
Resistance (R_S)	F = 100 MHz, I = 100 mA		3.0	Ω
Forward Voltage (V_F)	IF = 10 mA	0.85		V
Carrier Lifetime (TI)	IF = 10 mA	1.5		μS
I Region Width		175		μm

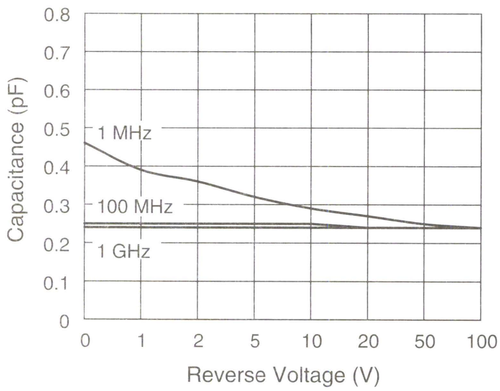
Typical Performance Data



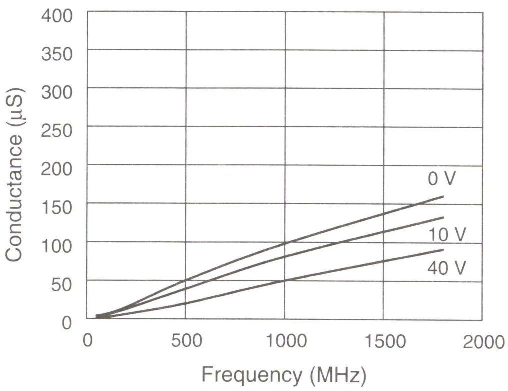
Series Resistance vs. Current @ 100 MHz



DC Characteristic



Capacitance vs. Reverse Voltage



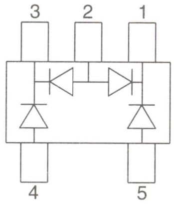
Conductance vs. Frequency and Reverse Voltage

Resistance vs. Temperature @ 100 MHz

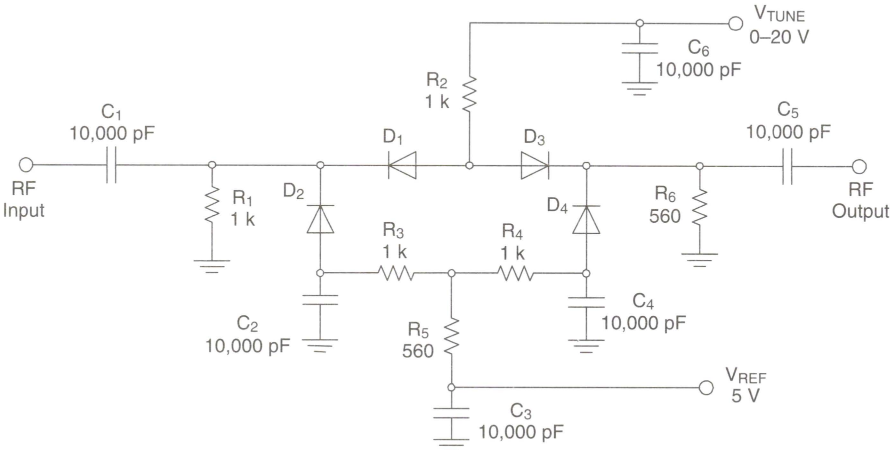
I_F (mA)	R -55°C (Ω)	R -15°C (Ω)	R +25°C (Ω)	R +65°C (Ω)	R +100°C (Ω)
0.02	2386.0	2360.0	2546.0	2520.0	2440.0
0.10	572.0	598.0	632.0	633.0	639.0
0.30	203.0	219.0	236.0	239.0	242.0
1.00	66.1	71.2	79.3	83.6	85.4
10.00	9.1	10.0	10.9	12.2	12.9
20.00	5.6	6.0	6.6	7.4	7.8
100.00	2.2	2.4	2.6	3.0	3.2

SMP1307-027 4 Diode PI Attenuator

The SMP1307-027 employs 4 PIN diode junctions in a 5-lead SOT package. It is configured for ease of insertion in the PI attenuator circuit commonly used for broadband TV distribution systems, covering a frequency range from 5 MHz to beyond 1 GHz.

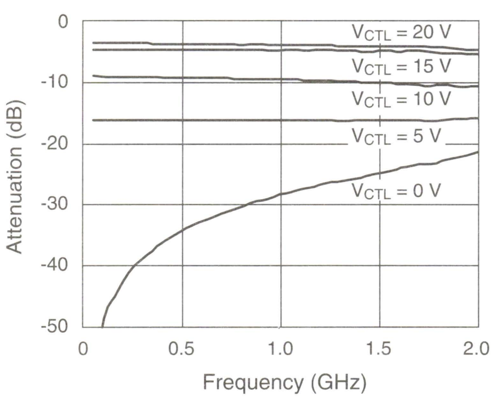


A broadband attenuator was designed using the SMP1307-027 showing good performance to 2 GHz. The attenuator was evaluated with a 50 Ω source and load impedance. The following figure shows the circuit diagram and measured performance.



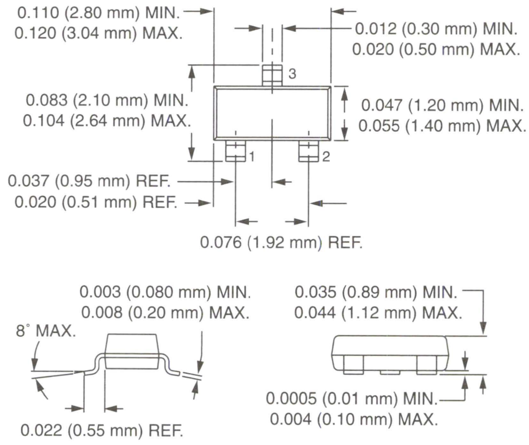
D_1–D_4 SMP1307-027

A 4 diode PI attenuator utilizing individual SMP1307-011 PIN diodes is described in the "A Wideband General Purpose PIN Diode Attenuator" Application Note.

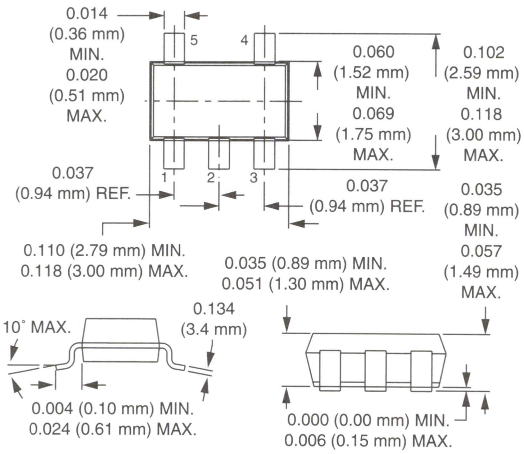


SMP1307-027 Attenuation vs. Frequency

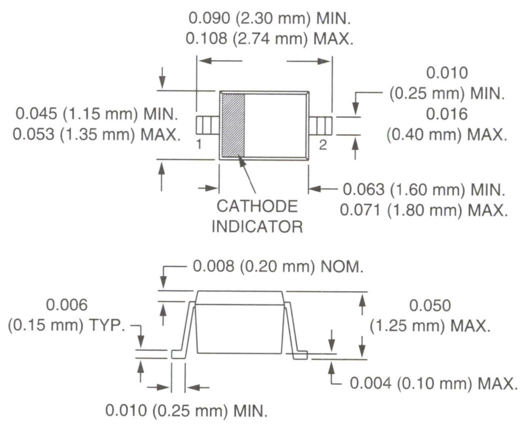
SOT-23



SOT-5



SOD-323



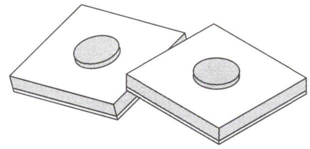
Silicon PIN Diode Chips

SKYWORKS

APD Series

Features

- Established Skyworks' PIN Diode Process
- For Switch and Attenuator Applications
- Low Capacitance Designs to 0.05 pF
- Voltage Ratings to 200 V
- Chip Size Smaller than 15 Mils Square



Absolute Maximum Ratings

Characteristic	Value
Power Dissipation	$Pdiss = \frac{175\text{-}Tamb}{\theta}$ W
Operating Temperature	-65°C to +175°C
Storage Temperature	-65°C to +200°C

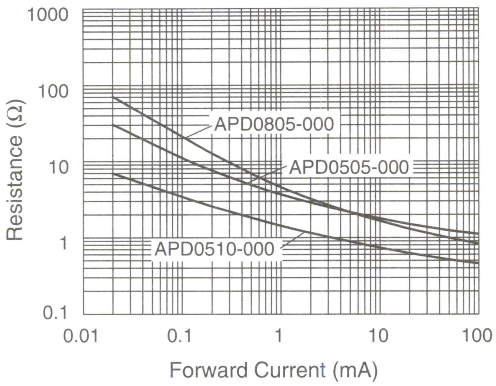
Description

Skyworks' APD Series of silicon PIN diode chips are designed for use as switch and attenuator devices in high performance hybrid microwave integrated circuits. These PIN diode designs are useful over a wide range of frequencies from below 100 MHz to beyond 30 GHz. These devices utilize Skyworks' well established silicon technology resulting in high resistivity and tightly controlled I region width PIN diodes. APD0505-00 through APD1510-000 are primarily designed for fast speed through moderate speed switch applications. They have low resistance and capacitance at zero bias and reverse bias. The thick I region APD2220-000 is primarily designed for low distortion attenuator applications.

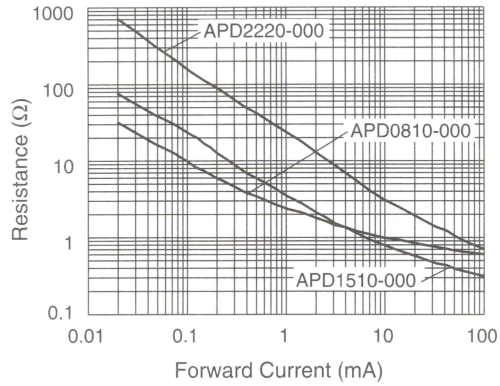
Electrical Specifications at 25°C

Part Number	Capacitance V_R = 50 V, 1 MHz (pF)	Capacitance V_R = 0 V, 1 MHz (pF)	R_S I = 10 mA, 500 MHz (Ω)	TL I = 10 mA (ns)	Voltage Rating I_R = 10 µA (V)	I Region (µM)	Thermal Resistance (Cc/W)	Contact Diameter (Mils)	Outline Drawing
	Max.	Typ.	Max.	Typ.	Min.	Nom.	Max.	Nom.	
Switching Applications									
APD0505-000	0.05	0.10	2.0	20	50	5	100	1.5	150-806
APD0510-000	0.10	0.20	1.5	40	50	5	80	2.5	150-801
APD0520-000	0.20	0.25	1.0	50	50	5	80	3.5	150-801
APD0805-000	0.05	0.10	2.0	100	100	8	80	2.0	150-801
APD0810-000	0.10	0.15	1.5	160	100	8	60	3.0	150-801
APD1510-000	0.10	0.20	2.0	300	200	15	60	3.0	150-801
APD1520-000	0.20	0.25	1.2	400	200	15	30	4.0	150-802
Attenuator Applications									
APD2220-000	0.20	0.20	4.0	100	100	50	80	7.5	149-815

Typical Performance Data



Resistance vs. Forward Current @ 1 GHz



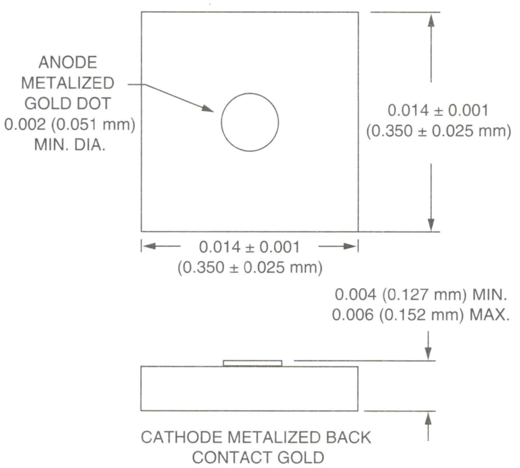
Resistance vs. Forward Current @ 1 GHz

SPICE Model Parameters

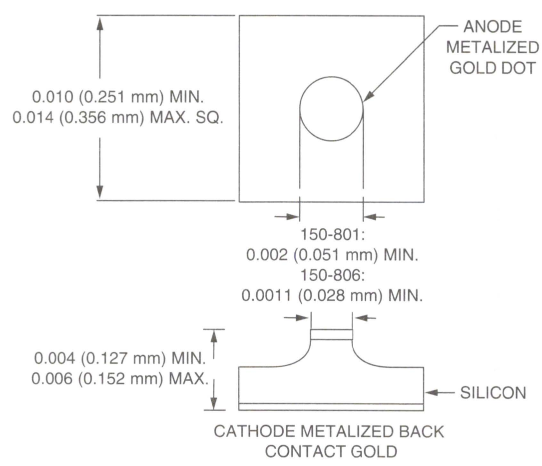
Description	Symbol	APD0505-000	APD0510-000	APD0805-000	APD0810-000	APD1510-000	APD2220-000	Unit
Saturation Current	IS	6.40E-14	5.50E-17	1.20E-11	1.50E-12	1.60E-10	2.00E-09	A
Series Resistance	R_S	0.25	0.50	1.00	0.30	1.00	0.20	Ω
Emission Coefficient	N	1.40	1.02	1.70	1.48	1.80	1.90	
Reverse Breakdown	B_V	50.00	50.00	100.00	100.00	200.00	200.00	V
Current at B_V	I_{BV}	10E-06	10E-06	10E-06	10E-06	10E-06	10E-06	A
Zero Bias Capacitance	C_{J0}	0.12E-12	0.18E-12	0.13E-12	0.16E-12	0.25E-12	0.2E-12	F
Junction Potential	V_J	1.00	1.00	1.00	1.00	1.00	1.00	V
Grading Coefficient	M	0.50	0.50	0.50	0.50	0.50	0.50	
Transit Time	TT	20E-9	40E-9	50E-9	160E-9	300E-9	400E-9	s

Outline Drawings

149-815



150 Series



Limiter Diodes

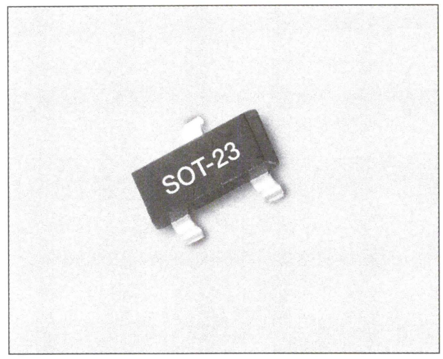
Plastic Packaged Limiter Diodes

SKYWORKS

SMP1330-005

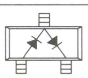
Features

- Low Distortion Design
- Characterized Limiter Performance 500 MHz to 2 GHz
- Low Insertion Loss
- Low Cost Plastic Package
- Available in Tape and Reel Packaging



Description

The SMP1330-005 is a limiter diode in a plastic package designed for use as a passive receiver protector in wireless and other UHF systems covering 500 MHz to 2 GHz. It employs Skyworks' limiter diode technology to produce a gold doped thin base limiter chip for low loss, low distortion performance and good limiter action. This device has been characterized in limiter circuits and tightly specified to insure consistent performance.



Series Pair
Marking: PQ2
SOT-23
♦ **SMP1330-005**
L_S = 1.5 nH

♦ Available through distribution.

Absolute Maximum Ratings

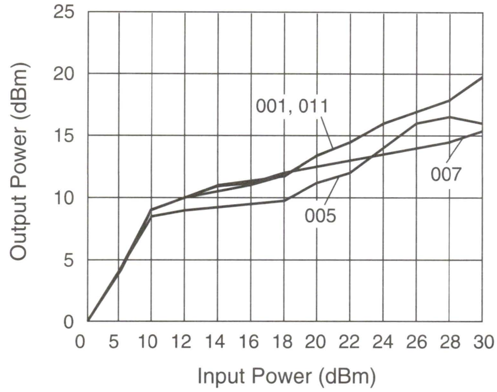
Characteristic	Value
Reverse Voltage (V_R)	20 V
Forward Current (I_F)	100 mA
CW Incident Power @ 25°C Lead Temperature	1 W
Peak Incident Power @ 1% Duty Factor 1 μS Pulse	100 W
Power Dissipation @ 25°C Lead Temperature (P_D)	250 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
ESD Human Body Model	Class 2

Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Series Resistance (R_S)	10 mA, 100 MHz		1.2	1.5	Ω
Capacitance (C_T)	0 V, 1 MHz		0.7	1.0	pF
Capacitance (C_T)	0 V, 1 GHz		0.7		pF
Conductance (G)	0 V, 1 GHz		50.0		μS
Carrier Lifetime (Tl)	I_F = 10 mA		4.0		nS
I Region Width			3.0		μm
Breakdown Voltage (V_{BR})	I_R = 10 μA	20	35.0	50.0	V

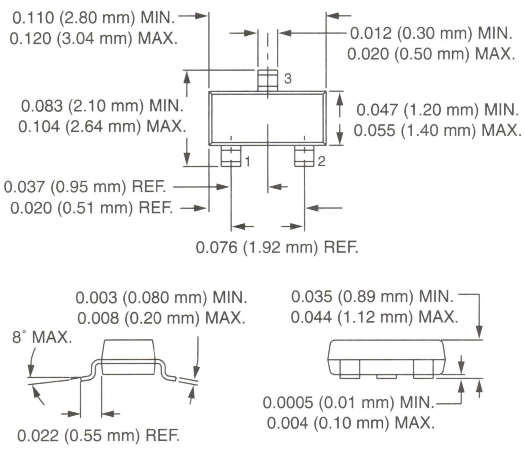
Skyworks Solutions, Inc. **[781] 376-3000** • Fax **[781] 376-3100** • Email **sales@skyworksinc.com** • **www.skyworksinc.com**

Typical Performance Data



Typical 1 GHz Limiter Performance

SOT-23



Packages

The SMP1330 series is available in one package configuration utilizing industry standard SOT-23.

SMP1330-005

SMP1330-005 Series Pair SOT-23

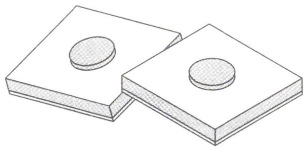
This series pair is designed for use as anti-parallel limiter diodes by externally connecting pins 1 and 2 of the SOT-23 package. In a limiter circuit, no DC return is needed and limiting action is improved because inductance is reduced to approximately 0.8 nH. A small increase in loss occurs from the higher capacitance and conductance.

Typical 1 GHz Limiter Performance

SMP1330	Condition	-005
Connection		Parallel
Insertion Loss	P = -20 dBm	0.3 dB
IP3	P = < 0 dBm	30.0 dBm
1 dB Compression		10.0 dBm
Attenuation at +20 dBm		8.8 dB
Attenuation at +30 dBm		14.0 dB

Silicon Limiter Diode Chips

CLA Series



Features

- Established Skyworks' Limiter Diode Process
- High Power, Mid-range and Clean-up Designs
- Low Insertion Loss (0.1 dB at 10 GHz)
- Power Handling to 66 dBm
- Tight Control of Basewidth
- Mesa and Planar Chip Designs

Description

Skyworks' CLA series of silicon limiter diode chips provides passive receiver protection over a wide range of frequencies from 100 MHz to beyond 30 GHz. These devices utilize Skyworks' well established silicon technology for high resistivity and tightly controlled thin base width PIN limiter diodes. Limiter circuits employing these devices will perform with strong limiting action and low loss.

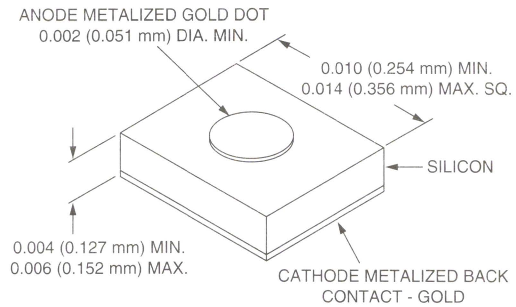
The CLA series consists of eight individual chip designs of different intrinsic region basewidths and capacitances designed to accommodate multi-stage limiter applications. The mesa constructed, thin basewidth, low capacitance CLA4601-000, CLA4602-000, CLA4604-000 and CLA4605-000 are designed for low level and clean-up applications. The CLA4603-000, CLA4606-000 through CLA4608-000 are planar designs designated for high power and mid-range applications.

Absolute Maximum Ratings

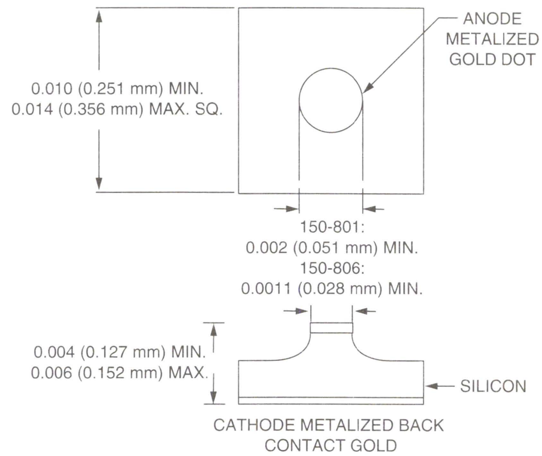
Characteristic	Value
Power Dissipation	$Pdiss = \frac{175 - Tamb}{\theta}$ W
For CW Signals	$\theta = \theta ave$
For Pulsed Signals	θ = DF x θave + θ pulse (θp @1 μS x Normalized θp from Figure 2)
Operating Temperature	-65°C to +175°C
Storage Temperature	-65°C to +200°C

Outline Drawings

149-801



150 Series



Electrical Specifications at 25°C

Part Number	Breakdown Voltage (V)	Basewidth (μm)	C_J@ 0 V (pF)	R_S @ 10 mA (Ω)	T_L @ 10 mA (nS)	Thermal Impedance (θ) Average (°C/W)	Thermal Impedance (θ) 1 μS Pulse (°C/W)	Top Contact Diam. (mils/mm)	Outline Drawing
	Min. – Max.	Nominal	Max.	Max.	Typ.	Max.	Typ.	Typ.	
CLA4601-000	15–30	1.0	0.15	2.5	5	120	15	1.2/0.030	150-806
CLA4602-000	15–30	1.0	0.2	2.0	5	80	10	1.5/0.038	150-806
CLA4603-000	20–45	1.5	0.2	2.0	5	100	10	1.5/0.038	149-801
CLA4604-000	30–60	2.0	0.15	2.5	7	100	10	1.5/0.038	150-806
CLA4605-000	30–60	2.0	0.2	2.0	7	70	7.0	2.5/0.064	150-801
CLA4606-000	45–75	2.5	0.2	2.0	10	80	7.0	2.5/0.064	150-801
CLA4607-000	120–180	7.0	0.2	2.0	50	40	1.2	3.0/0.076	149-801
CLA4608-000	120–180	7.0	0.6	1.2	100	15	0.3	5.0/0.127	149-801

1. Capacitance, C_J, measured at 1 MHz.
2. Resistance, R_S, measured at 100 MHz.
3. CW thermal resistance for infinite heat sink.
4. Pulse thermal resistance for single 1 μS pulse.

Typical Performance at 25°C

Part Number	Insertion Loss @ -10 dBm (dB)	Input Power for 1 dB Loss (dBm)	Maximum Pulsed Input Power (dBm)	Output at Max. Pulsed Input (dBm)	Maximum CW Input Power (W)	Recovery Time (nS)
CLA4601-000	0.1	7	47	21	2	5
CLA4602-000	0.1	7	50	24	3	5
CLA4603-000	0.1	10	50	22	2	10
CLA4604-000	0.1	12	47	24	3	10
CLA4605-000	0.1	12	50	27	4	10
CLA4606-000	0.1	15	53	27	3	20
CLA4607-000	0.1	20	60	39	6	50
CLA4608-000	0.2	20	66	44	15	100

1. Insertion loss for CLA4601-000 through CLA4607-000 at 10 GHz; insertion loss for CLA4608-000 at 5 GHz.
2. Limiter power results at 1 GHz for shunt connected single limiter diode and DC return in 50 Ω line.
3. Maximum pulsed power for 1 μS pulse and 0.1% duty factor with chip at 25°C heat sink. Derate linearly to 0 W at 175°C.
4. Maximum CW input power at 25°C heat sink. Derate linearly to 0 W at 175°C.
5. Recovery time to insertion loss from limiting state.

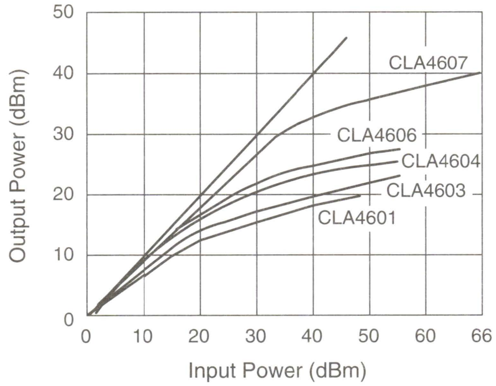


Figure 1
Typical Peak Leakage Power at 1 GHz

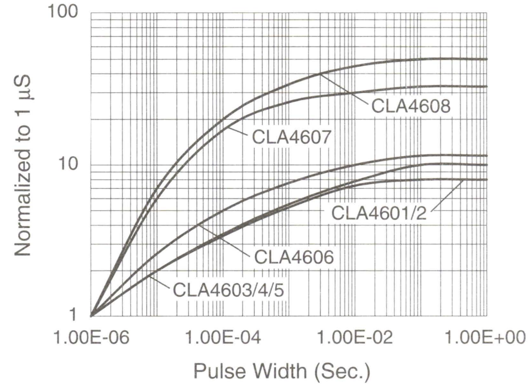


Figure 2
Normalized Pulsed Thermal Impedance

Schottky Diodes

Application/Selection Guide

Market	Function	Suggested Part Number
Handsets	RF Power Detection	SMS3925-079, SMS3922 Series, SMS3923 Series
LNB/DBS	Balanced Mixers	SMS7621-005, SMS7621-006, SMS1546-005
CATV	RF Power Detection	SMS3923 Series, SMS3924 Series
RF ID Tags	RF Power Detection Switching	SMS3922 Series, SMS3923 Series, SMS7621 Series, SMS7630 Series SMS3923 Series
WLAN	RF Power Detection	SMS7630-079
Base Stations/ Communication Systems	Double Balanced Mixers	**Crossover Quads** SMS3926-023, DMF3926-100 SMS3927-023, DME3927-100 SMS3928-023, DMJ3928-100 **Dual Crossover Quads** DMF3945-103, DME3946-103 DMJ3947-103

Chip Scale Schottky Diodes

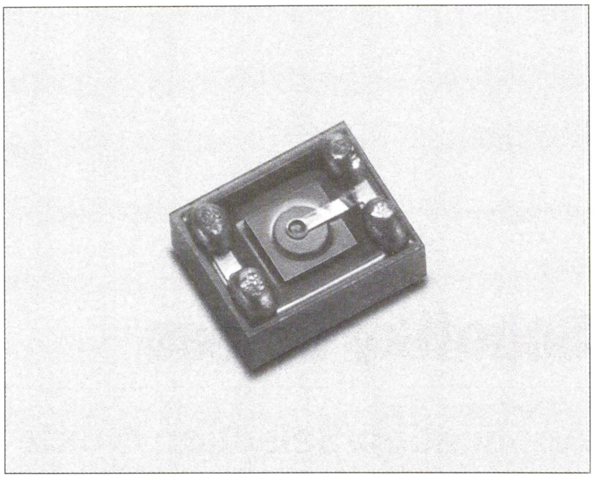
SMS7621-050, SMS7630-050

Features

- Package Height is Half of the SC-79 (0.012 mm)
- Low Inductance (0.25 nH)
- Designed for High Volume Wireless Detector and Mixer Applications
- Available in Tape and Reel Packaging

Description

The SMS7621-050 and SMS7630-050 are chip scale packaged, surface mount Schottky diodes designed for high volume RF and microwave detector and mixer applications. The low barrier diode, SMS7621-050, and the zero bias detector diode, SMS7630-050, combine Skyworks' advanced semiconductor technology with state-of-the-art packaging techniques to offer one of the smallest surface mount devices available. All diodes are 100% DC tested and deliver tight parameter distribution, minimizing performance variability. Applications include high sensitivity ID tags and wireless systems. SPICE model parameters are available as a design tool.

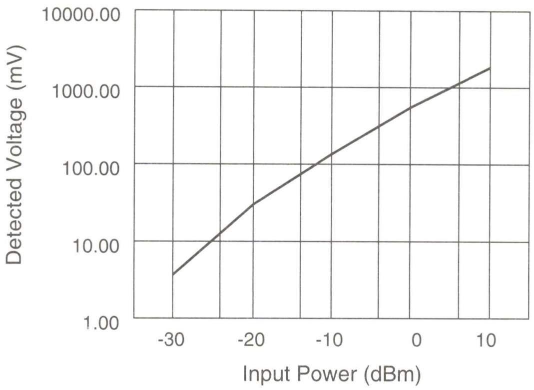


Absolute Maximum Ratings

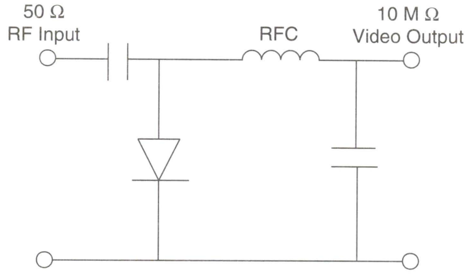
Characteristic	Value
Reverse Voltage (V_R)	Rated V_B
Power Dissipation @ 25°C Lead Temperature (P_D)	75 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
Forward Current (Standby State I_F)	50 mA
ESD — Human Body Model	Class 0

Electrical Specifications at 25°C

Part Number	Description	Breakdown Voltage Min. (V)	C_T V_R = 0 V F = 1 MHz Typ. (pF)	Forward Voltage Typ. (mV)			R_T @ 10 mA (Ω) Typ.	R_V (Ω) Typ.
				0.1 mA	1.0 mA	10 mA		
SMS7621-050	Low Barrier Detector/Mixer	2 V @ 10 µA	0.18	220	290	430	12	
SMS7630-050	Zero Bias Detector	1 V @ 100 µA	0.21	85	160	400	22	5000

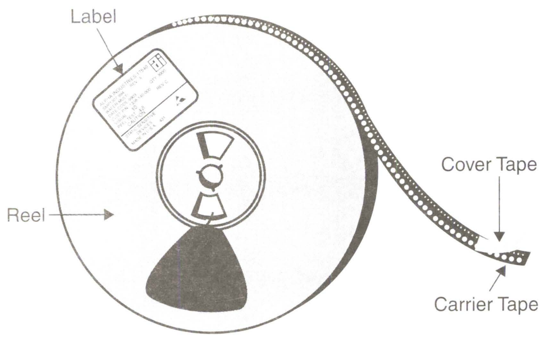


Typical Detector Characteristics @ 1.8 GHz

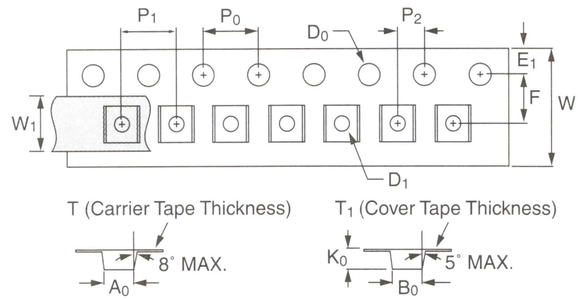


SPICE Model Parameters (Per Junction)

Parameter	Unit	SMS7621	SMS7630
IS	A	4E-8	5E-06
R_S	Ω	12	20
N		1.05	1.05
TT	S	1E-11	1E-11
C_{J0}	pF	0.10	0.14
M		0.35	0.40
E_G	eV	0.69	0.69
XTI		2	2
F_C		0.5	0.5
B_V	V	3	2
I_{BV}	A	1E-5	1E-4
V_J	V	0.51	0.34



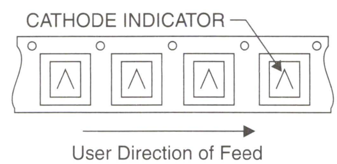
Tape Dimensions



Description	Sym.	Chip Scale
Cavity		
Length	A_0	0.65±0.05
Width	B_0	0.76±0.05
Depth	K_0	0.53±0.05
Pitch	P_1	2.00±0.10
Bottom Hole Diameter	D_1	N/A
Perforation		
Diameter	D_0	1.50±0.10
Pitch	P_0	4.00±0.10
Position	E_1	1.75±0.10
Carrier Tape		
Width	W	8.00±0.20
Thickness	T	0.43±0.05
Cover Tape		
Width	W_1	5.40±0.10
Tape Thickness	T_1	0.062±0.01
Distance		
Cavity to Perforation (Width Direction)	F	3.50±0.05
Cavity to Perforation (Length Direction)	P_2	1.00±0.025

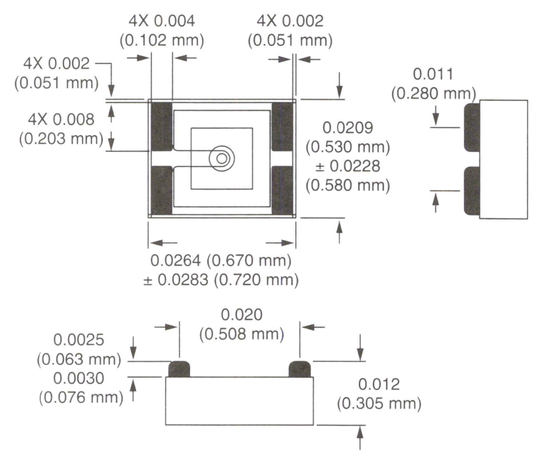
Note: All dimensions are in mm.

Chip Scale (-050)



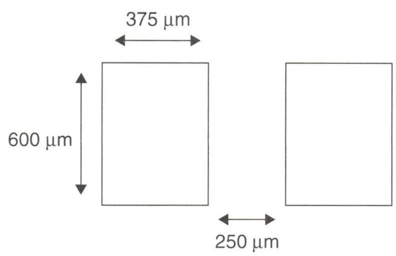
Standard Reel Size	7"	13"
Standard Reel Quantity	3,000	N/A

-050



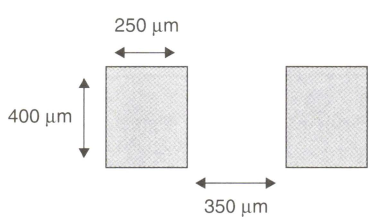
Land Pattern

The recommended surface mount pad pattern ensures quality solder joint formation and high-yielding assembly, while using minimum board space. The dimensions apply to both Solder Mask Defined (SMD) as well as Non-Solder Mask Defined (NSMD) pads. However, NSMD pads, in which the solder mask is pulled back from the metal pad, are preferred. This type of pad definition generally produces improved solder joint reliability as well as an increased gap under the component. The increased gap is desirable for enhanced cleaning of flux residue and component underfill for applications in which the component will be encapsulated.

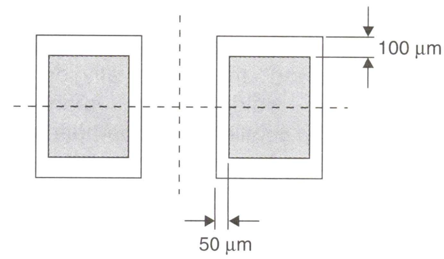


Solder Printing

The recommended land pattern, when used in conjunction with the following solder deposit recommendation, provides quality solder joint formation and high yielding assembly. Solder should be deposited with a stencil of foil thickness from 100–125 µm, and preferably have apertures that are laser-etched and electro-polished for optimal paste release. The chip scale package is compatible with most lead-based and lead-free solder pastes, though a type 3 or type 4 paste is preferred for the fine aperture printing.

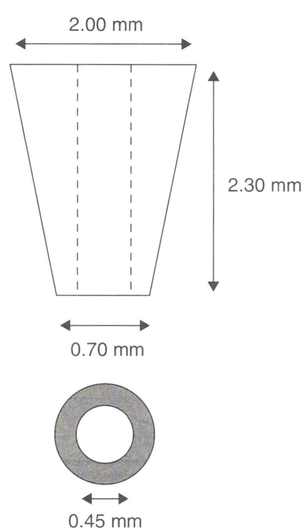


The solder deposit should be centered on the land pattern as shown.



Component Placement

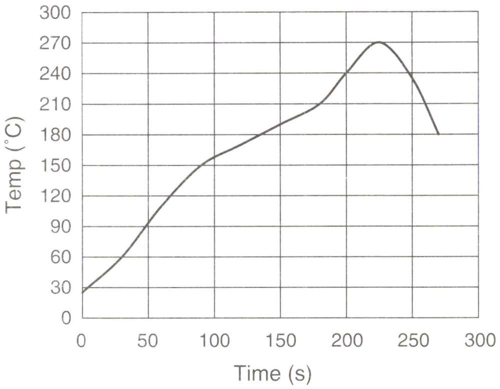
The CSP can easily be picked and placed on most placement systems. Care should be taken to select a pick nozzle that matches the component footprint. Vision alignment after pick can be done to the package edges or the package leads, depending on the ability of the individual placement machine. The component should be placed as centered as possible to the pad and print patterns to assure even wetting and an absence of tilt or skew.



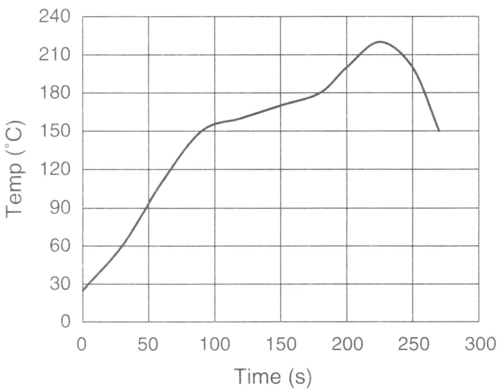
Solder Reflow

Solder reflow is best suited to convection or IR reflow systems, though convection reflow will always give more rapid and uniform thermal transfer. The CSP can be successfully reflowed in either air or nitrogen atmospheres. The solder paste manufacturer's recommended reflow profile should be adhered to and care should be taken to ensure that the profile is adjusted for variability in thermal mass amongst components. Attached are generic profiles for eutectic tin-lead solder and a typical lead-free solder.

These should only be used as a guideline, with the paste manufacturers recommended profile taking precedence. A standard solvent flux clean can be safely employed to remove flux residue from the device edges.



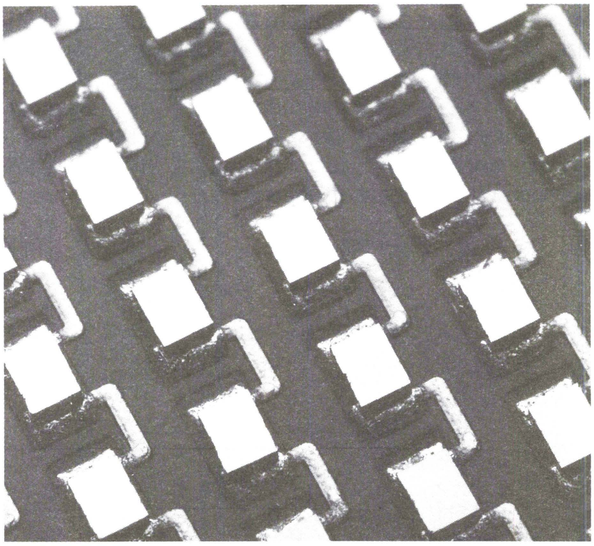
Lead Free Profile



Eutectic Tin-Lead Profile

Finished Product

Once reflowed, the component should be fairly centered on the land pattern. Solder should wet evenly to CSP leads and the component should not display excessive tilt or skew. A solvent flux clean can be safely employed if desired.

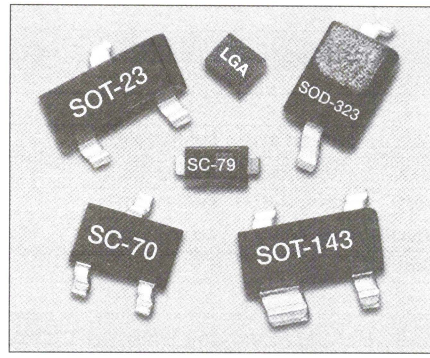


Surface Mount Mixer and Detector Schottky Diodes

SKYWORKS

Features

- Designed for High Volume Commercial Applications
- Available Lead (Pb)-Free MSL-1 @ 250°C per JEDEC J-STD-020
- Tight Parameter Distribution
- Available as Singles and Pairs
- Available in Tape and Reel Packaging



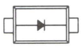
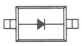
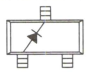
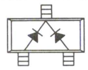
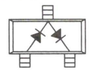
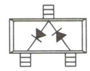
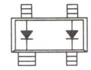
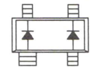
Description

These low cost, surface mountable plastic packaged silicon mixer Schottky diodes are designed for RF and microwave mixers and detectors. They include low barrier diodes and zero bias detectors, combining Skyworks' advanced semiconductor technology with low cost packaging techniques. All diodes are 100% DC tested and deliver tight parameter distribution, minimizing performance variability. They are available in SC-70, SC-79, SOD-323, SOT-23, SOT-143, and LGA packages. Wiring configurations include singles, common cathode, series pairs and unconnected pairs. Applications include low noise receivers used in high sensitivity ID tags, wireless systems, radio designs and may be used at frequencies to 10 GHz. SPICE model parameters are included as a design tool.

NEW Lead (Pb)-Free "environmentally friendly" packaging available: Skyworks offers the SMS7630-079LF and SMS7630-517 Lead (Pb)-Free package as a green alternative.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	Rated V_B
Forward Current - Steady State (I_F)	50 mA
Power Dissipation (P_D)	75 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
Junction Temperature (T_J)	150°C
Soldering Temperature	260°C for 5 Seconds

								
Single	Single	Single	Common Cathode	Series Pair	Reverse Series Pair	Unconnected Pair	Reverse Unconnected Pair	Unconnected Pair
SC-79	SOD-323	SOT-23		SOT-23	SOT-23	SOT-143	SOT-143	LGA
				SMS1546-005				
				Marking: SG2				
SMS7621-079	**SMS7621-011**	**SMS7621-001**		**SMS7621-005**	**SMS7621-006**	**SMS7621-015**		
Cathode Mark	Cathode Mark	Marking: SH1		Marking: SH2	Marking: SH8	Marking: SH7		
SMS7630-079	**SMS7630-011**	**SMS7630-001**		**SMS7630-005**	**SMS7630-006**		**SMS7630-020**	**SMS7630-517**
SMS7630-079LF	Cathode Mark	Marking: SD1		Marking: SD2	Marking: SD8		Marking: SD0	
Anode Mark								
L_S = 0.7 nH	L_S = 1.5 nH	L_S = 1.5 nH		L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 0.6 nH
			SC-70	SC-70	SC-70			
			SMS7621-074	**SMS7621-075**	**SMS7621-076**			
			Marking: SH3	Marking: SH2	Marking: SH8			
				SMS7630-075	**SMS7630-076**			
				Marking: SD2	Marking: SD8			
			L_S = 1.4 nH	L_S = 1.4 nH	L_S = 1.4 nH			

LF denotes Lead (Pb)-Free packaging.

Electrical Specifications at 25°C (Per Junction)

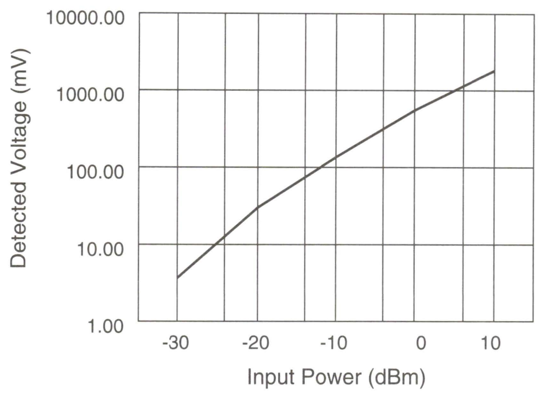
Low Barrier Mixer and Detectors

Part Number	Barrier	V_B @ 10 µA (V)	C_T @ 0 V (pF)	V_F @ 1 mA (mV)	Pair Configuration (b) V_F @ 1 mA (mV)	R_T* @ 10 mA (Ω)
		Min.	Typ.		Max.	Max.
SMS1546 Series	Low	2	0.50	200–270	10	8
SMS7621 Series	Low	2	0.25	260–320	10	18

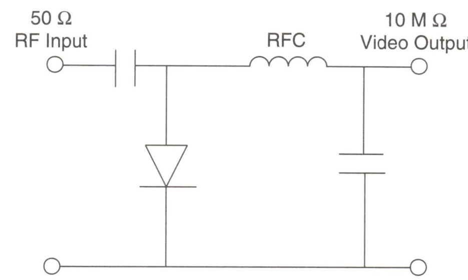
*R_T is the slope resistance.

Zero Bias Detectors

Part Number	V_B @ 100 µA (V)	C_T @ 0.15 V (pF)	V_F @ 0.1 mA (mV)	V_F @ 1 mA (mV)	Pair Configuration (b) VF @ 1 mA (mV)	R_V (Ω)
	Min.	Typ.			Max.	Typ.
SMS7630 Series	1.0	0.30	60–120	135–240	10	5000



Typical Detector Characteristics @ 1.8 GHz



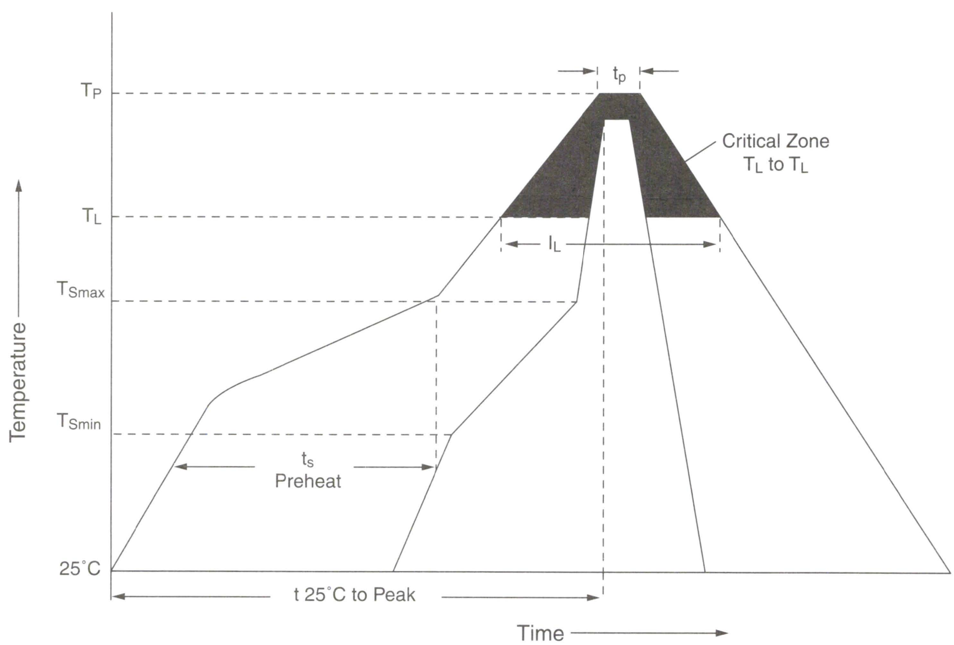
SPICE Model Parameters (Per Junction)

Parameter	Unit	SMS1546	SMS7621	SMS7630
IS	A	3E-7	4E-8	5E-06
R_S	Ω	4	12	20
N		1.04	1.05	1.05
TT	S	1E-11	1E-11	1E-11
C_{J0}	pF	0.38	0.10	0.14
M		0.36	0.35	0.40
E_G	eV	0.69	0.69	0.69
XTI		2	2	2
F_C		0.5	0.5	0.5
B_V	V	3	3	2
I_{BV}	A	1E-5	1E-5	1E-4
V_J	V	0.51	0.51	0.34

Recommended Solder Reflow Profiles

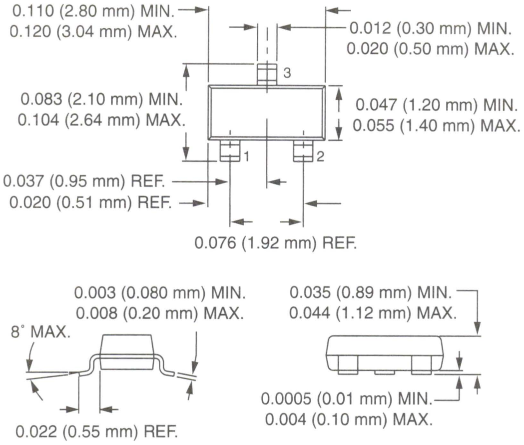
Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average Ramp-Up Rate (T_L to T_P)	3°C/Second Max.	3°C/Second Max.
Preheat Temperature Min. (T_{Smin}) Temperature Max. (T_{Smax}) Time (Min. to Max.) (ts)	 100°C 150°C 60–120 Seconds	 150°C 200°C 60–80 Seconds
T_{Smax} to T_L Ramp-up Rate	—	3°C/Second Max.
Time Maintained Above: Temperature (T_L) Time (t_L)	 183°C 60–150 Seconds	 217°C 60–150 Seconds
Peak Temperature (T_P)	240 +0/-5°C	250 +0/-5°C
Time Within 5°C of Actual Peak Temperature (tp)	10–30 Seconds	20–40 Seconds
Ramp-Down Rate	6°C/Second Max.	6°C/Second Max.
Time 25°C to Peak Temperature	6 Minutes Max.	8 Minutes Max.

All temperatures refer to the topside of the package, measured on the package body surface.
Reference JEDEC J-STD-020B.

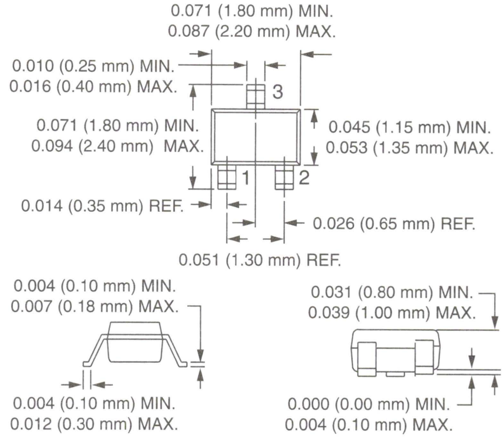


Reference JEDEC J-STD-020

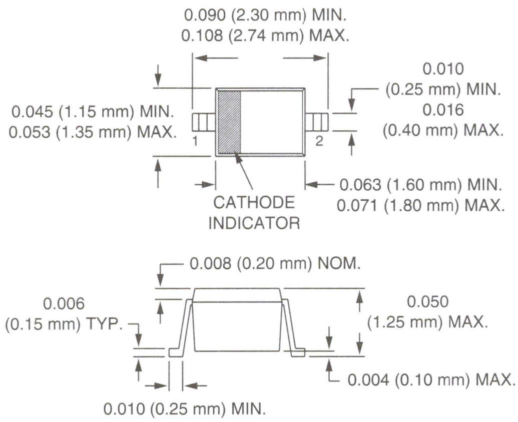
SOT-23



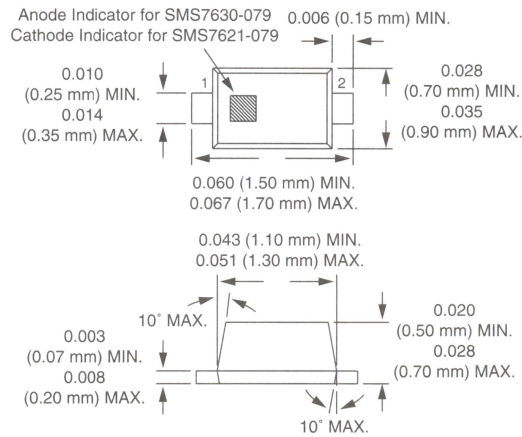
SC-70



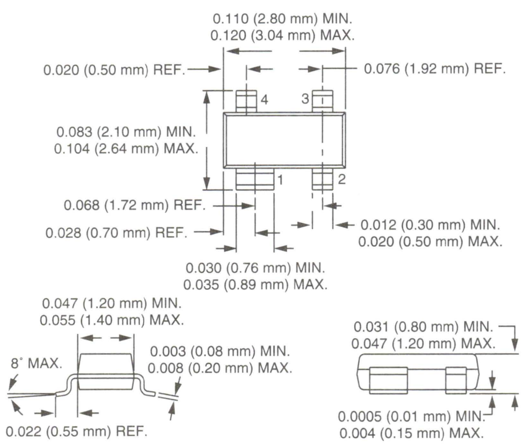
SOD-323



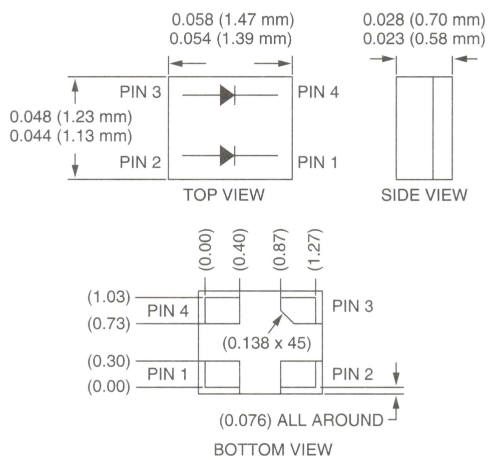
SC-79



SOT-143



LGA

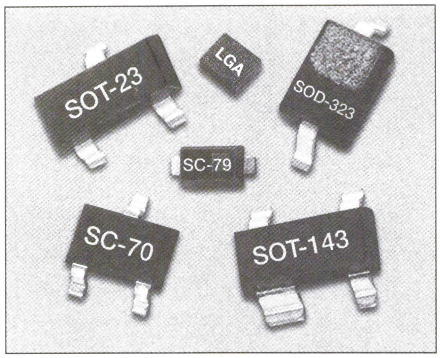


Surface Mount General Purpose Schottky Diodes

SKYWORKS

Features

- Tight Parameter Distribution
- Available as Singles and Pairs
- 100% DC Tested
- Designed for High Volume Commercial Applications
- Available in Tape and Reel Packaging

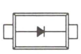
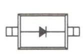
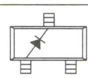
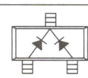
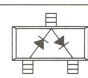
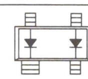
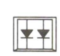


Description

This series of 8, 20 and 70 V rated low cost plastic packaged Schottky diodes are designed for general purpose use in RF applications as detectors, mixers and switches and in digital pulse forming applications. All diodes are fully characterized including SPICE model parameters and deliver tight parameter distribution, minimizing performance variability. They are available in SC-70, SC-79, SOD-323, SOT-23, SOT-143 and LGA packages. Wiring configurations include singles, common cathode, series pairs and unconnected pairs. Available in tape and reel for pick and place manufacturing.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	Rated V_B
Forward Current - Steady State (I_F)	50 mA
Forward Current - 1 mS Pulse (I_F)	1A
Power Dissipation (P_D)	75 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
Junction Temperature (T_J)	150°C
Soldering Temperature	260°C for 5 Seconds
ESD Human Body Model	Class 1B

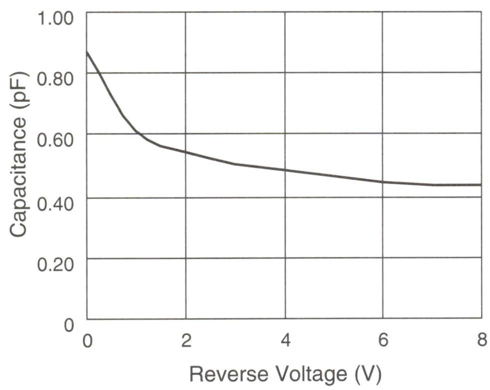
						
Single	Single	Single	Common Cathode	Series Pair	Unconnected Pair	Unconnected Pair
SC-79	SOD-323	SOT-23	SOT-23	SOT-23	SOT-143	LGA
♦ **SMS3922-079**	♦ **SMS3922-011**	♦ **SMS3922-001**	♦ **SMS3922-004**	♦ **SMS3922-005**	♦ **SMS3922-015**	
Cathode Mark	Cathode Mark	Marking: SA1	Marking: SA3	Marking: SA2	Marking: SA7	
♦ **SMS3923-079**	♦ **SMS3923-011**	♦ **SMS3923-001**	♦ **SMS3923-004**	♦ **SMS3923-005**	♦ **SMS3923-015**	**SMS3923-517**
Cathode Mark	Cathode Mark	Marking: SB1	Marking: SB3	Marking: SB2	Marking: SB7	
♦ **SMS3924-079**	♦ **SMS3924-011**	♦ **SMS3924-001**	♦ **SMS3924-004**	♦ **SMS3924-005**	♦ **SMS3924-015**	
Cathode Mark	Cathode Mark	Marking: SC1	Marking: SC3	Marking: SC2	Marking: SC7	
L_S = 0.7 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 1.5 nH	L_S = 0.6 nH
				SC-70		
				♦ **SMS3922-075**		
				Marking: SA2		
				♦ **SMS3923-075**		
				Marking: SB2		
				♦ **SMS3924-075**		
				Marking: SC2		
				L_S = 1.4 nH		

♦ Available through distribution.

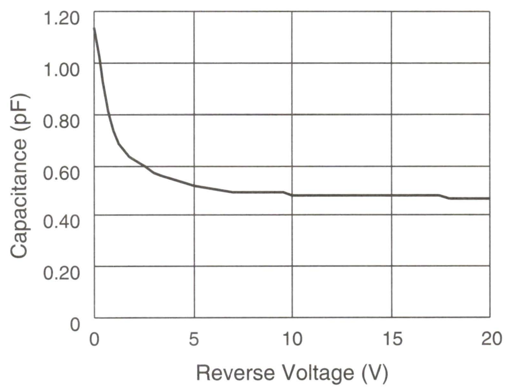
Electrical Specifications at 25°C

Part Number	V_B @ 10 μA (V)	I_R	C_T @ 0 V (pF)	V_F @ 1 mA (mV)	Pair Configuration (b) V_F @ 1 mA (mV)	V_F
	Min.				Max.	Max.
SMS3922 Series	8	@ 1 V < 100 nA	0.63–1.03	280–340	10	@ 10 mA < 450 mV
SMS3923 Series	20	@ 15 V < 500 nA	0.83–1.23	310–370	10	@ 35 mA < 1000 mV
SMS3924 Series	70	@ 50 V < 200 nA	1.43–1.83	490–550	10	@ 15 mA < 1000 mV

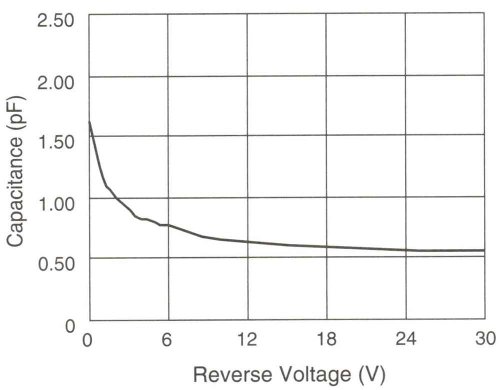
Typical Performance Data



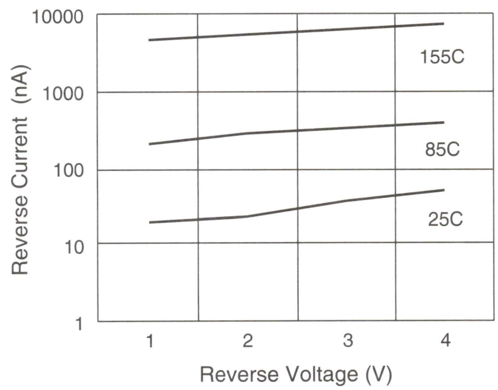
SMS3922 Total Capacitance vs. Reverse Voltage



SMS3923 Total Capacitance vs. Reverse Voltage



SMS3924 Total Capacitance vs. Reverse Voltage

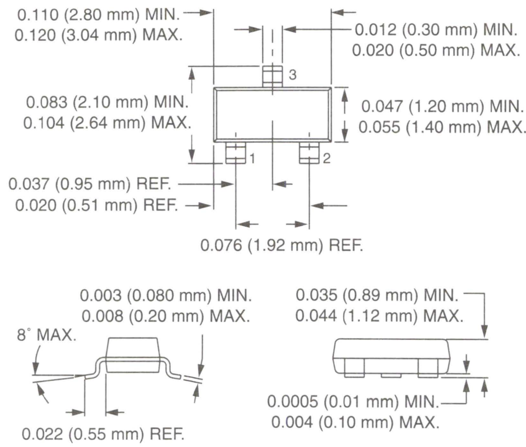


SMS3922 Reverse Current vs. Reverse Voltage

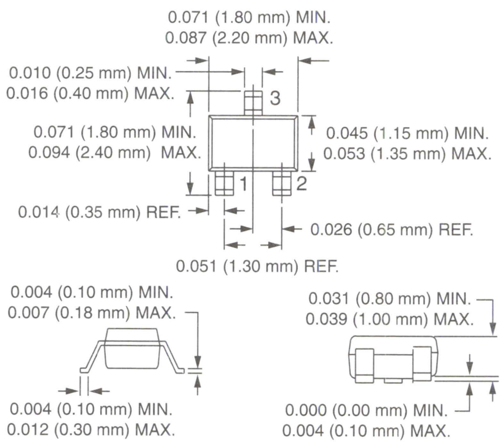
SPICE Model Parameters

Parameter	Unit	SMS3922	SMS3923	SMS3924
IS	A	3E-8	5E-9	2E-11
R_S	Ω	9	11	11
N		1.08	1.05	1.08
TT	S	8E-11	8E-11	8E-11
C_{J0}	pF	0.7	0.9	1.5
M		0.26	0.24	0.4
E_G	eV	0.69	0.69	0.69
XTI		2	2	2
F_C		0.5	0.5	0.5
B_V	V	20	46	100
I_{BV}	A	1E-5	1E-5	1E-5
V_J	V	0.595	0.64	0.84

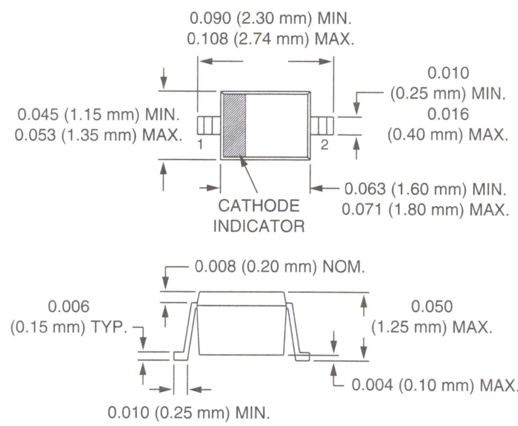
SOT-23



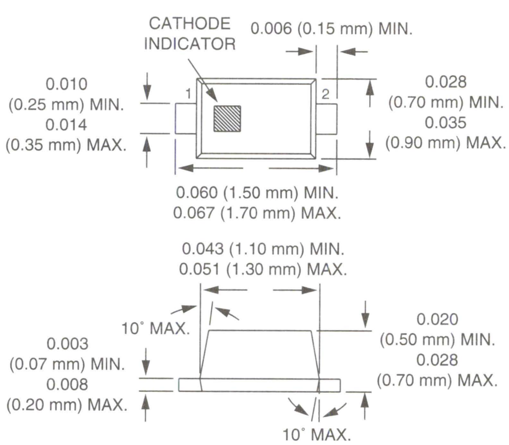
SC-70



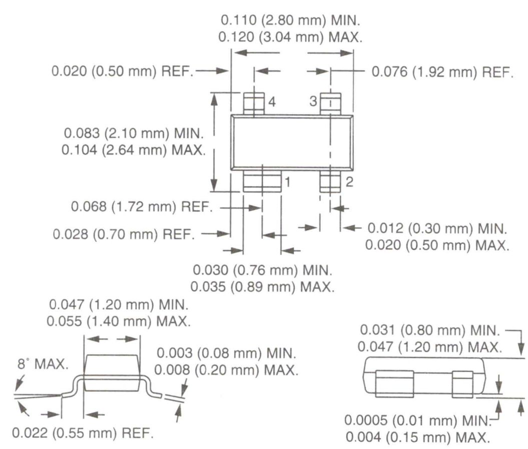
SOD-323



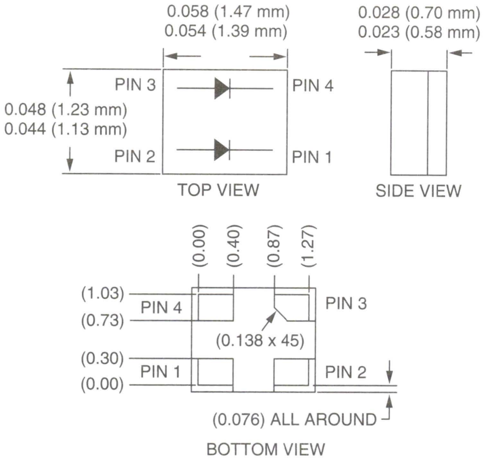
SC-79



SOT-143



LGA


0.058 (1.47 mm)
0.054 (1.39 mm)
0.028 (0.70 mm)
0.023 (0.58 mm)
PIN 3
PIN 4
0.048 (1.23 mm)
0.044 (1.13 mm)
PIN 2
PIN 1
TOP VIEW
SIDE VIEW
(0.00)
(0.40)
(0.87)
(1.27)
(1.03)
PIN 4
(0.73)
PIN 3
(0.138 x 45)
(0.30)
PIN 1
(0.00)
PIN 2
(0.076) ALL AROUND
BOTTOM VIEW

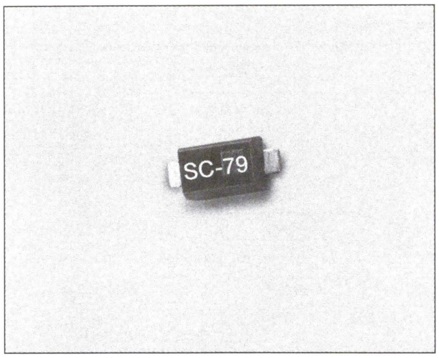
Low Capacitance High Voltage Schottky Diode

SKYWORKS

SMS3925-079

Features

- Silicon Schottky Diode for Detector Applications
- Ultra Small SC-79 Package
- Designed for High Volume, Low Cost Applications
- Available in Tape and Reel Packaging



Description

The SMS3925-079 is a 40 V, 0.6 pF RF Schottky diode designed for use as a level detector in wireless handsets and for general purpose switching applications. The SMS3925-079 is packaged in the surface mount miniature SC-79 package and is designated for low cost, high volume applications.

Absolute Maximum Ratings

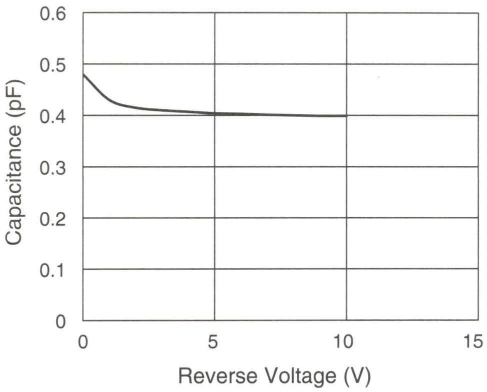
Characteristic	Value
Reverse Voltage (V_R)	40 V
Forward Current - 1 mS Pulse (I_F)	1 A
Forward Current - Steady State (I_F)	50 mA
Power Dissipation (P_D)	250 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
Junction Temperature (T_J)	150°C
Electrostatic Discharge (ESD) - Human Body Model (HBM)	Class 1B

Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Reverse Current (I_R)	V_R = 40 V			10	uA
Capacitance (C_T)[1]	V_R = 0 V, F = 1 MHz		0.48	0.6	pF
Forward Voltage (V_F)	I_F = 1 mA	0.57	0.62	0.67	V

1. Capacitance is total capacitance (C_T), junction capacitance (C_J) + package capacitance (C_P).

Typical Performance Data

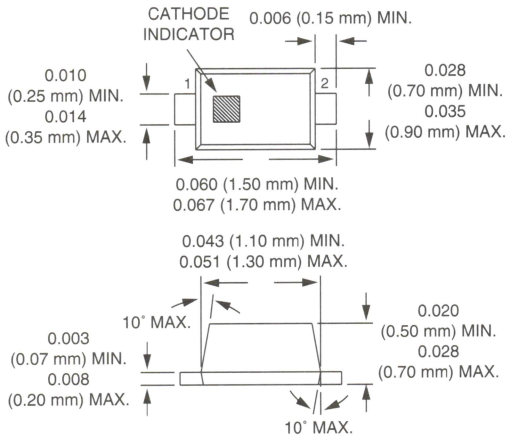


Total Capacitance vs. Reverse Voltage

SPICE Model Parameters

Parameter	Units	SMS3925
IS	A	1.8E-09
R_S	Ω	5.4
N	-	1.7
TT	S	8E-11
C_{J0}	pF	0.36
M	-	0.24
E_G	eV	0.69
XTI	-	2
F_C	-	0.5
B_V	V	58
I_{BV}	A	1.00E-05
V_J	V	0.800

SC-79

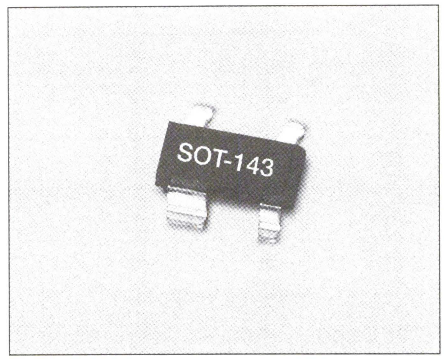


Surface Mount Schottky Quad Mixer Diodes

SKYWORKS

Features

- Tight Parameter Distribution
- Available as Ring Quads, Crossover Quads, Bridge Quads and Octoquads
- 100% DC Tested
- Designed for High Volume Commercial Applications
- Available in Tape and Reel Packaging



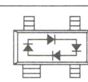
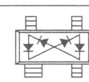
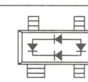
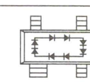
Description

Skyworks' offers a series of low cost devices in a SOT-143 package. They cover low, medium and high barrier junctions as ring quads, crossover quads and bridge quads. An octoquad ring is also offered for high dynamic range applications. These devices are constructed utilizing Skyworks' monolithic chip technology, assuring uniformity of electrical characteristics for each junction. The low capacitance of Skyworks' ring and crossover quads are designed for double balanced mixer applications covering wireless frequencies into C-band. The bridge quads are designated for modulators and frequency multiplier applications. These diodes are 100% DC tested and deliver tight parameter distribution, minimizing performance variability. They complement Skyworks' product line of Schottky singles and pairs available in SC-70, SC-79, SOD-323, SOT-23 and SOT-143 packages. Available in tape and reel for pick and place manufacturing.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	Rated V_B
Forward Current - Steady State (I_F)	50 mA
Power Dissipation (P_D)	75 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C
Junction Temperature (T_J)	150°C
Soldering Temperature	260°C for 5 Seconds
ESD Human Body Model	Class 1B

Electrical Specifications at 25°C (Per Junction)

Barrier	V_B @ 10 µA (V)	C_J @ 0 V (pF)	V_F @ 1 mA (mV)	ΔV_F @ 1 mA (mV)	R_T[1] @ 10 mA (Ω)				
						SOT-143			
	Min.			Max.	Max.	Ring Quad	Crossover Quad	Bridge Quad	Octoquad
Low	2	0.3-0.5	200-270	10	8	♦ SMS3926-022	♦ SMS3926-023	♦ SMS3929-021	
						Marking: SE4	Marking: SE5	Marking: SQE	
Medium	2	0.3-0.5	310-370	10	8		♦ SMS3927-023	♦ SMS3930-021	
							Marking: SJ5	Marking: SRE	
High	4	0.3-0.5	520-580	10	8		♦ SMS3928-023	♦ SMS3931-021	♦ SMS3940-026
							Marking: SK5	Marking: SSE	Marking: STG

♦ Available through distribution.
1. R_T is the slope resistance.
All parameters are based upon a single junction.

SPICE Model Parameters (Per Junction)

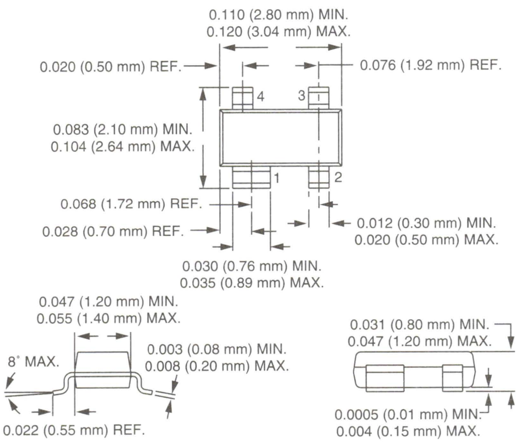
Parameter	Unit	SMS3926 SMS3929	SMS3927 SMS3930	SMS3928 SMS3931 SMS3940
IS	A	2.5E-07	1.3E-09	9E-13
R_S	Ω	4	4	4
N		1.04	1.04	1.04
TT	S	1E–11	1E–11	1E–11
C_{J0}	pF	0.42	0.39	0.39
M		0.32	0.37	0.42
E_G	eV	0.69	0.69	0.69
XTI		2	2	2
F_C		0.5	0.5	0.5
B_V	V	2	3	4
I_{BV}	A	1.00E–05	1.00E–05	1.00E–05
V_J	V	0.495	0.595	0.800

All parameters are based upon a single junction.

Typical Forward Voltage Characteristics at 25°C

Part Number	V_F @ 0.01 mA (mV)	V_F @ 0.10 mA (mV)	V_F @ 1.0 mA (mV)	V_F @ 10.0 mA (mV)
	Typ.	Typ.	Typ.	Typ.
SMS3926	100	165	232	324
SMS3927	206	271	338	428
SMS3928	423	488	555	641

SOT-143



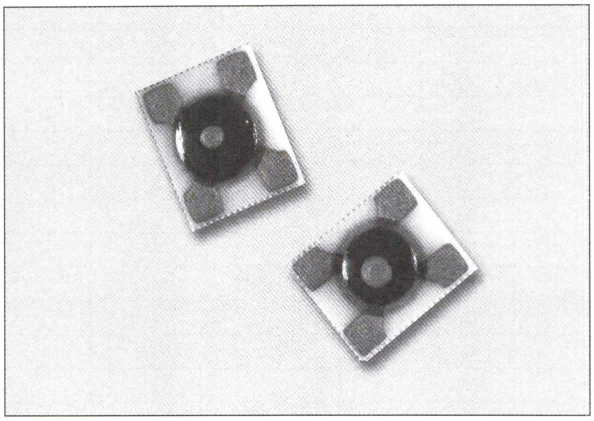
Chip On Board Mixer Quads

Features

- High Volume Automatic Assembly
- For Microwave MIC Assembly and Automated High Volume Manufacturing
- Mechanically Rugged Design
- 100% DC Tested
- Three Barrier Heights for Customized Mixer Performance

Description

Skyworks' ceramic Chip on Board (COB) mixer quads are designed for high performance RF and microwave receiver applications. These devices utilize Skyworks' advanced silicon beamless Schottky technology, combined with precision ceramic COB assembly techniques, to achieve a high degree of device reliability in commercial applications.



Absolute Maximum Ratings

Characteristic	Value
Maximum Current (I_{MAX})	50 mA
Power Dissipation (P_D) CW	75 mW/Junction
Storage Temperature (T_{ST})	-65°C to +175°C
Operating Temperature (T_{OP})	-65°C to +150°C
ESD Human Body Model	Class 1B

Electrical Specifications at 25°C

Part Number	Barrier	V_F @ 1 mA (mV)		(Δ) V_F @ 1 mA[1] (mV)	C_J @ 0 V (pF)		(Δ) C_T @ 0 V[2] (pF)	R_T @ 10 mA (Ω)	Outline Drawing
		Min.	Max.	Max.	Min.	Max.	Max.	Max.	
Ring Quad (to 6 GHz)									
DMF3926-101	Low	200	260	15	0.3	0.5	0.07	8	101
DME3927-101	Medium	300	400	15	0.3	0.5	0.07	8	101
DMJ3928-101	High	525	625	15	0.3	0.5	0.07	8	101
Crossover Ring Quad (to 6 GHz)									
DMF3926-100	Low	200	260	15	0.3	0.5	0.07	8	100
DME3927-100	Medium	300	400	15	0.3	0.5	0.07	8	100
DMJ3928-100	High	525	625	15	0.3	0.5	0.07	8	100
Back-to-Back Crossover Quad (to 6 GHz)									
DMF3945-103	Low	200	260	15	0.3	0.5	0.07	8	103
DME3946-103	Medium	300	400	15	0.3	0.5	0.07	8	103
DMJ3947-103	High	525	625	15	0.3	0.5	0.07	8	103

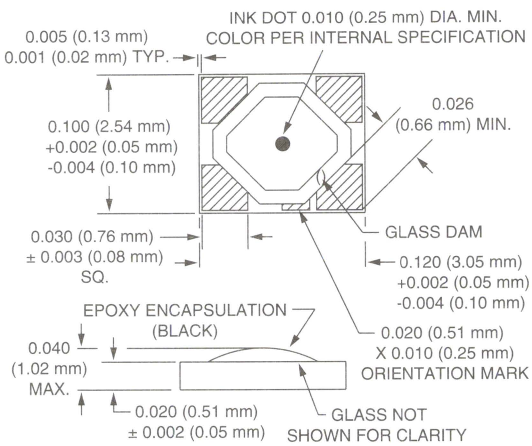
Part Number	Barrier	V_F @ 1 mA (mV)		(Δ) V_F @ 1 mA[1] (mV)	C_J @ 0 V (pF)		(Δ) C_T @ 0 V[2] (pF)	R_T @ 10 mA (Ω)	V_B @ 10 µA (V)	Outline Drawing
		Min.	Max.	Max.	Min.	Max.	Max.	Max.	Min.	
Bridge Quad (to 6 GHz)										
DMF3929-102	Low	200	260	15	0.3	0.5	0.07	8	2	102
DME3930-102	Medium	300	400	15	0.3	0.5	0.07	8	3	102
DMJ3931-102	High	525	625	15	0.3	0.5	0.07	8	4	102

1. Forward voltage difference between package electrodes.
2. Capacitance difference between package electrodes.

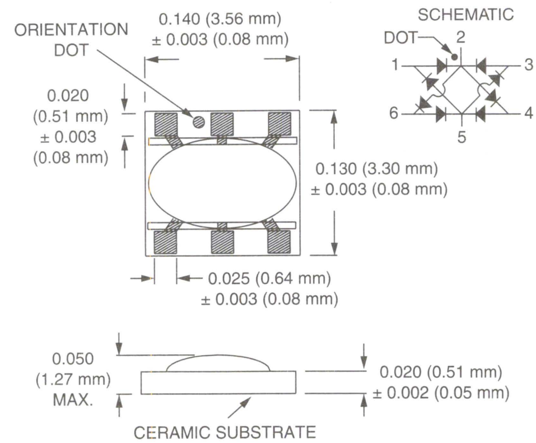
SPICE Model Parameters (Per Junction)

Parameter	Unit	DMF3926 DMF3929 DMF3945	DME3927 DME3930 DME3946	DMJ3928 DMJ3931 DMJ3947
IS	A	2.5E–07	1.3E–09	9.0E–13
R_S	Ω	4	4	4
N		1.04	1.04	1.04
TT	s	1E–11	1E–11	1E–11
C_{J0}	pF	0.42	0.39	0.39
M		0.32	0.37	0.42
E_G	eV	0.69	0.69	0.69
XTI		2	2	2
F_C		0.5	0.5	0.5
B_V	V	2	3	4
I_{BV}	A	1.0E–05	1.0E–05	1.0E–05
V_J	V	0.495	0.595	0.800

100, 101, 102



103



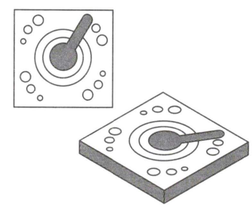
Notes:
1. Bottom side is free of metalization.
2. The minimum specified area of the contact pads (0.017 x 0.022) shall be free of epoxy.

Silicon Schottky Diode Chips

SKYWORKS

Features

- For Detector and Mixer Applications
- Low Capacitance for Usage Beyond 40 GHz
- ZBD and Low Barrier Designs
- P-Type and N-Type Junctions
- Large Bond Pad Chip Design



Description

Skyworks' product line of silicon Schottky diode chips are intended for use as detector and mixer devices in hybrid integrated circuits at frequencies from below 100 MHz to higher than 40 GHz. Skyworks' "Universal Chip" design features a 4 mil diameter bond pad that is offset from the semiconductor junction preventing damage to the active junction as a result of wire bonding.

As power-sensing detectors, these Schottky diode chips all have the same voltage sensitivity so long as the output video impedance is much higher than the video resistance of the diode. Figure 1 shows the expected detected voltage sensitivity as a function of RF source impedance in an untuned circuit. Note that sensitivity is substantially increased by transforming the source impedance from 50 Ω to higher values. Maximum sensitivity occurs when the source impedance equals the video resistance.

In a detector circuit operating at zero bias, depending on the video load impedance, a ZBD device with R_V less than 10 kΩ may be more sensitive than a low barrier diode with R_V greater than 100 kΩ. Applying forward bias reduces the diode video resistance as shown in Figure 2. Lower video resistance also increases the video bandwidth but does not increase voltage sensitivity, as shown in Figure 3. Biased Schottky diodes have better temperature stability and also may be used in temperature compensated detector circuits.

P-type Schottky diodes generate lower 1/F noise and are preferred for Doppler mixers and biased detector applications. The bond pad for the P-type Schottky diode is the cathode. N-type Schottky diodes have lower parasitic resistance, R_S, and will perform with lower conversion loss in mixer circuits. The bond pad for the N-type Schottky diode is the anode.

Electrical Specifications at 25°C

Part Number	Barrier	Junction Type	C_J[1] (pF)	R_T[2] (Ω)	V_F @ 1 mA (mV)	V_B[3] (V)	R_V @ Zero Bias (kΩ)	Outline Drawing
			Max.	Max.	Min.–Max.	Min.	Typ.	
CDC7630-000	ZBD	P	0.25	30	135–240	1	5.5	526-006
CDC7631-000	ZBD	P	0.15	80	150–300	2	7.2	526-006
CDB7619-000	Low	P	0.10	40	275–375	2	735	526-006
CDB7620-000	Low	P	0.15	30	250–350	2	537	526-006
CDF7621-000	Low	N	0.10	20	270–350	2	680	526-011
CDF7623-000	Low	N	0.30	10	240–300	2	245	526-011

1. C_J for low barrier diodes specified at 0 V. C_J for ZBDs specified at 0.15 V reverse bias.
2. R_T is the slope resistance at 10 mA. R_S Max. may be calculated from: $R_S = R_T - 2.6 \times N$.
3. V_B for low barrier diodes is specified at 10 μA. V_B for ZBDs is specified at 100 μA.

Typical Performance Data

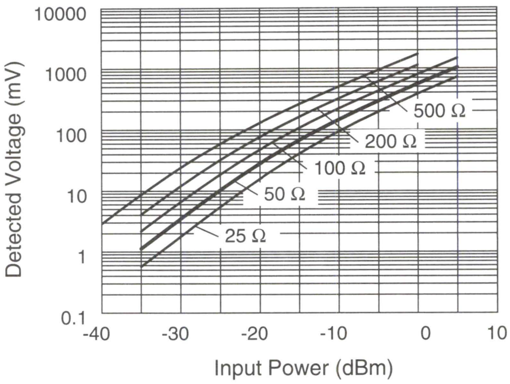
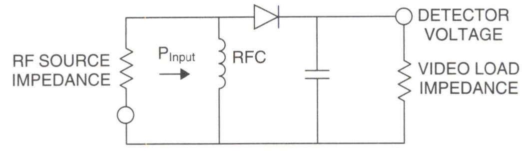
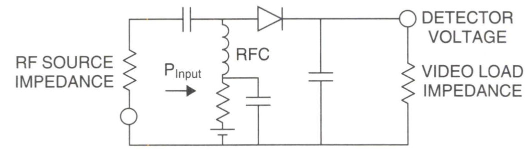


Figure 1. Detected Voltage vs. Input Power and RF Source Impedance



Zero Biased Detector



Biased Detector

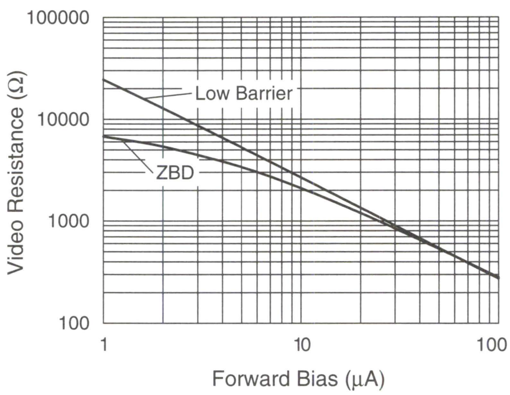


Figure 2. Video Resistance vs. Forward Bias Current

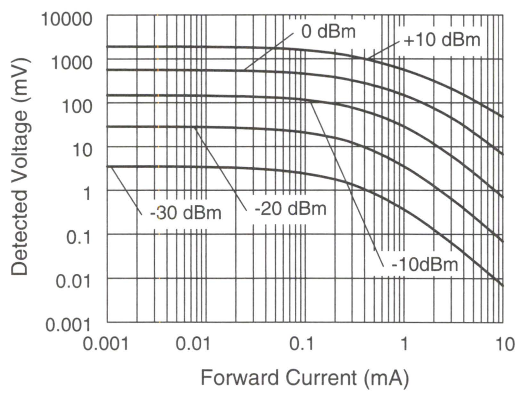


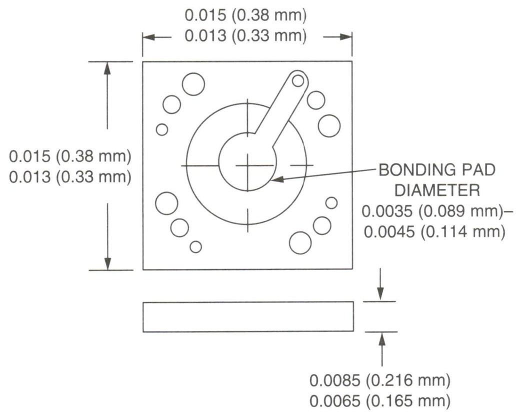
Figure 3. Detected Voltage vs. Forward Current

SPICE Model Parameters

Parameter	CDB7619	CDB7620	CDF7621	CDF7623	CDC7630	CDC7631	Units
IS	3.70E-08	5.40E-08	4.0E-08	1.1E-07	5.0E-06	3.8E-06	A
R_S	9	14	12	6	20	51	Ω
N	1.05	1.12	1.05	1.04	1.05	1.05	
TT	1E-11	1E-11	1E-11	1E-11	1E-11	1E-11	S
C_{J0}	0.08	0.15	0.10	0.22	0.14	0.08	pF
M	0.35	0.35	0.35	0.32	0.40	0.4	
E_G	0.69	0.69	0.69	0.69	0.69	0.69	eV
XTI	2.0	2.0	2.0	2.0	2.0	2.0	
F_C	0.5	0.5	0.5	0.5	0.5	0.5	
B_V	2.0	4.0	3.0	2.0	2.0	2.0	V
I_{BV}	1.00E-05	1.00E-05	1.0E-05	1.0E-05	1.0E-04	1.0E-04	A
V_J	0.495	0.495	0.495	0.495	0.340	0.340	V

Outline Drawing

526-006, 526-011



526-006 = Cathode bond pad.
526-011 = Anode bond pad.

Absolute Maximum Ratings

Characteristic	Value
Reverse Voltage (V_R)	Voltage Rating
Forward Current (I_F)	50 mA
Power Dissipation (P_D)	75 mW
Storage Temperature (T_{ST})	-65°C to +150°C
Operating Temperature (T_{OP})	-65°C to +150°C

GaAs Flip Chip Schottky Diodes

SKYWORKS

Features

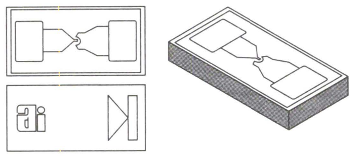
- Designed for High Volume Designs
- High Frequency (20–100 GHz)
- Exceeds Environmental Requirements for MIC & Hybrid Applications
- Designed for Low Junction Capacitance and Low Series Resistance
- Applications Include PCN Mixers and Circuits, As Well As Low Power, Fast Switching
- Low Parasitic Flip Chip Configuration

Description

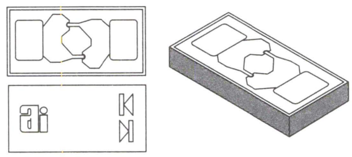
This new series of GaAs Schottky barrier diodes offer high performance at commercial market prices. They are designed for low junction capacitance, as well as low series resistance. Diodes are designed for MIC work (hard and soft substrates), but the leadless design eliminates the problems associated with mounting of beam lead diodes.

Due to its rigid construction, it exceeds environmental requirements for MIC and hybrid applications. Diodes can be supplied on expandable film frame for high speed pick and place process. Standard packing will be in a waffle pack. Flexible conductive epoxy is the most effective method for circuitry attachments. Standard mounting temperatures should not exceed 175°C.

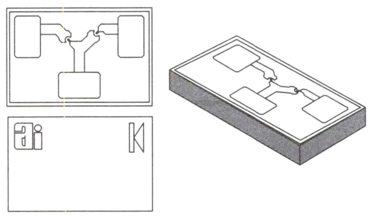
Single - DMK2783-000, DMK2790-000



Anti-Parallel - DMK2308-000



Series Pair - DMK8001-000

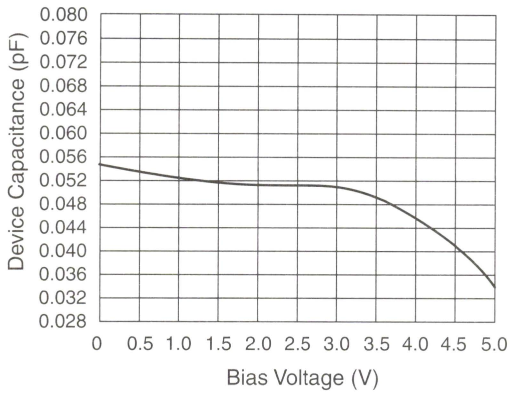


Electrical Specifications at 25°C

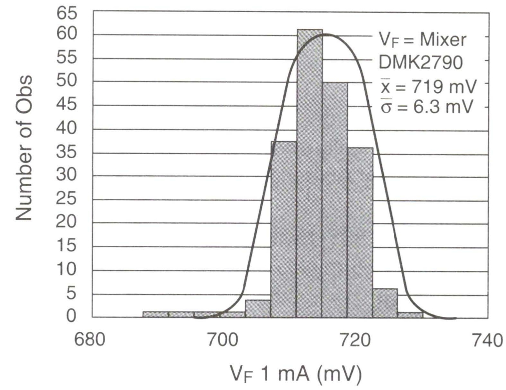
Recommended Frequency (GHz)	V_B[1] @ 10 µA (V)	C_T[2] 0 V, 1 MHz (pF)		R_S @ 10 mA (Ω)	V_F @ 1 mA (mV)		Single	Series Pair	Anti-Parallel
		Min.	Max.	Max.	Min.	Max.	540-011	540-012	540-025
20–100	3.0	0.03	0.05	9	680	780	DMK2783-000		
20–100	3.0	0.04	0.07	7	650	750	DMK2790-000		DMK2308-000
20–100	3.0	0.05	0.08	7	650	750		DMK8001-000	

1. V_B cannot be measured nondestructively in anti-parallel configuration.
2. C_T = junction capacitance plus 0.02 pF (overlay).

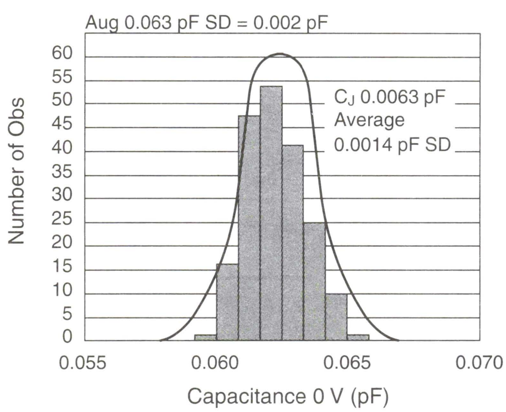
Typical Parameter Distribution on Wafer



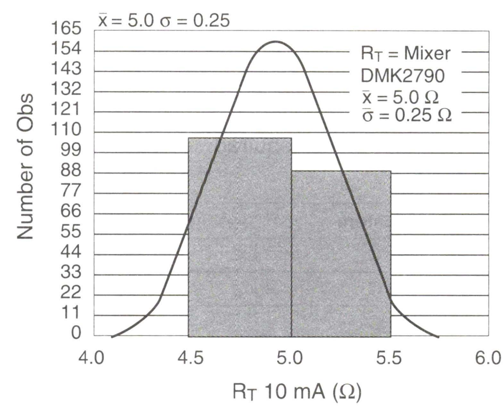
Capacitance/Voltage Variation



Histogram



Histogram



Histogram

Spice Parameters (Per Junction)

I_S Amp	R_S Ω	n	T_D S	C_J0 pF	m	E_G eV	V_J eV	X_{TI}	FC	B_V V	I_{BV} A
0.5 E–12	4	1.05	1E–11	0.05	0.26	1.43	0.82	2	0.5	4.0	1E–05

Suggested Setup Values For WEST-BOND Model 7200A Epoxy Die Bonder

Materials

Epoxy

Microelectronic grade one component, solvent-free silver-filled, electrically conductive adhesive — example: Ablebond 8380 by Ablestick.

Dispense Tube

WEST-BOND B-1831-1 with 9.5 mil I.D., or WEST-BOND B-1831-2 with 15.5 mil I.D. Other sizes available.

Die Pickup Tool

SPT Part Number 2101-W625-CT-031 x 0.016 x 0.0075. Hole diameter 0.016" face diameter 0.031", O.D. 0.625". Use vacuum pressure to pick and place chip.

Adjustment

Bond Force

35 grams at tool.

Dispense Air

30 psi.

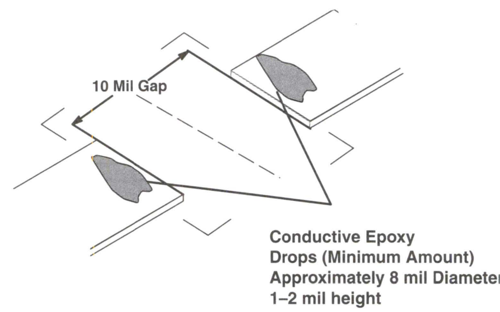
Dispense Time

To give diameter of dot required.

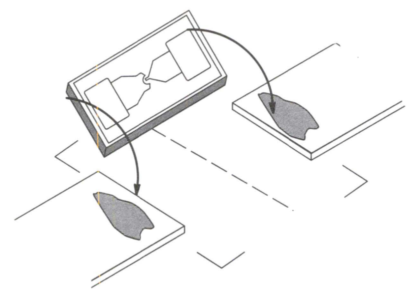
Curing Time

Temperature	Time
250°C	10 min.
130°C	20 min.
100°C	60 min.
85°C	120 min.

Flexible Conductive Epoxy Mounting of Skyworks' Beamless Flip Chip Diodes – To Soft or Hard Substrate – As Plated

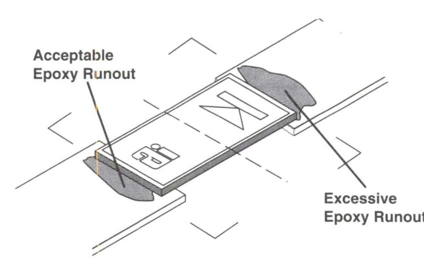


Deposit Conductive Epoxy



Perform Die Attach

- Flip Device
- Align Bond Pads to Epoxy Dot (Alignment Marks Help)
- Use Even Pressure to Make Correct Connection

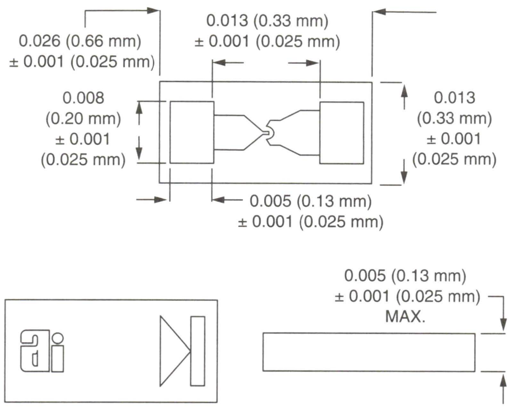


Cure Epoxy & DC Continuity Check

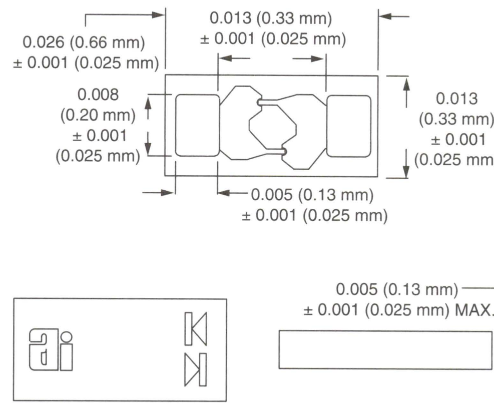
- Inspect for Adequate Epoxy Fillet
- Cure According to Mfg. Preferred Schedule. Typically 110–150°C @ 60 Minutes, or 150°C, 4 Minutes for Snap-Cure Epoxies

Outline Drawings

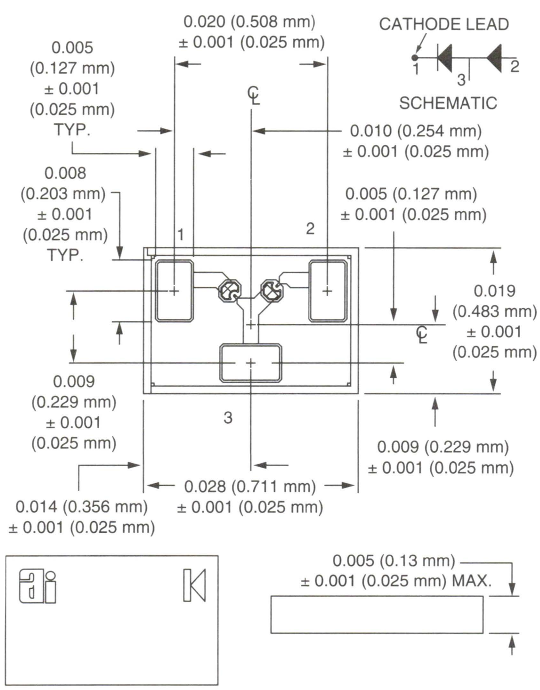
540-011



540-025



540-012

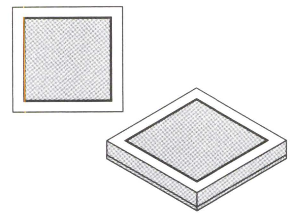


Chip Capacitors

MIS Chip Capacitors

SKYWORKS

SC Series



Features

- Readily Available From Stock
- High Reliability Silicon Oxide–Nitride Dielectric
- Low Loss — Typically 0.04 dB in a 50 Ω System
- Operation through 26 GHz
- Wide Temperature Operation

Description

Skyworks' MIS Chip Capacitors are available in a wide range of sizes and capacitance values. They are frequently used in applications requiring DC blocking, and RF bypassing, or as a fixed capacitance tuning element in filters, oscillators, and matching networks. The devices have a dielectric composed of thermally grown silicon dioxide over which a layer of silicon nitride is deposited. This dielectric possesses a low temperature coefficient of capacitance, very high insulation resistance. The devices also exhibit excellent long term stability making them suitable for high reliability applications. The capacitors have a high dielectric breakdown which permits the use of thin dielectrics resulting in larger capacitance per unit area than our previous catalog offerings. The temperature coefficient is less that 50 ppm/°C, and operation is suitable from -65°C to 200°C. Compared to ceramic capacitors, Skyworks' MIS chip capacitors offer higher Q, and a lower insertion loss of 0.04 dB, in a 50 Ω system. Insulation resistance is greater than 10^5M Ω. To accommodate high volume automated assembly methods, wafers can be supplied on expanded film frame. To reduce cost, chips can be supplied with only sample testing packaged in vials. Packaging in waffle packs with 100% electrical test and visual inspection is always available if required.

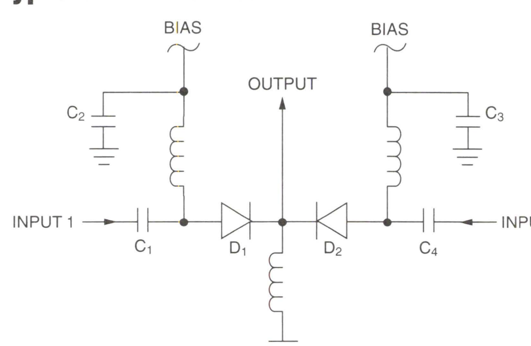
Absolute Maximum Ratings

Characteristic	Value
Operating Temp Range (T_{OP})	-65 to +200°C
Storage Temp Range (T_{STG})	-65 to +200°C
Dielectric Withstanding Voltage	100 V

Electrical Specifications

Capacitance Range[1]: 0.8 to 1000 pF
Temperature Coefficient: 50 ppm/°C Typical
Capacitance Tolerance[2]: ±20%
Operating Temperature: -65°C to 200°C
Dielectric Withstanding Voltage: 100 V
Insulation Resistance: 10^5 Megohms Typical
Leakage Current: Typ. < 1 nA

Typical SPDT Switch



C_2, C_3 — Chip MIS Capacitor
C_1, C_4 — Chip or Beam — Lead MIS Capacitor
D_1, D_2 DSG6474 Beam — Lead PIN Diode

Electrical Specifications

Part Number	Capacitance (+ 20%)	Chip Dimensions (+ 1 mil)
SC00080710	0.8	7 mil Pad/10 mil Chip
SC00080912	0.8	9 mil Pad/12 mil Chip
SC00120710	1.2	7 mil Pad/10 mil Chip
SC00120912	1.2	9 mil Pad/12 mil Chip
SC00180710	1.8	7 mil Pad/10 mil Chip
SC00180912	1.8	9 mil Pad/12 mil Chip
SC00260710	2.6	7 mil Pad/10 mil Chip
SC00260912	2.6	9 mil Pad/12 mil Chip
SC00380710	3.8	7 mil Pad/10 mil Chip
♦ SC00380912	3.8	9 mil Pad/12 mil Chip
SC00560710	5.6	7 mil Pad/10 mil Chip
♦ SC00560912	5.6	9 mil Pad/12 mil Chip
SC00680710	6.8	7 mil Pad/10 mil Chip
SC00680912	6.8	9 mil Pad/12 mil Chip
SC00820710	8.2	7 mil Pad/10 mil Chip
♦ SC00820912	8.2	9 mil Pad/12 mil Chip
SC00821518	8.2	15 mil Pad/18 mil Chip
SC01000710	10	7 mil Pad/10 mil Chip
♦ SC01000912	10	9 mil Pad/12 mil Chip
SC01001518	10	15 mil Pad/18 mil Chip
SC01500710	15	7 mil Pad/10 mil Chip
SC01500912	15	9 mil Pad/12 mil Chip
SC01501518	15	15 mil Pad/18 mil Chip
♦ SC02200912	22	9 mil Pad/12 mil Chip
SC02201518	22	15 mil Pad/18 mil Chip
SC03301518	33	15 mil Pad/18 mil Chip
SC04701518	47	15 mil Pad/18 mil Chip
♦ SC06801518	68	15 mil Pad/18 mil Chip
SC10002430	100	24 mil Pad/30 mil Chip
♦ SC10003440	100	34 mil Pad/40 mil Chip
SC22203440	222	34 mil Pad/40 mil Chip
♦ SC33303440	333	34 mil Pad/40 mil Chip
SC50004450	500	44 mil Pad/50 mil Chip
♦ SC99906068	1000	60 mil Pad/68 mil Chip

♦ Available through distribution.

Example

Part Number Structure — SCXXXXYYZZ

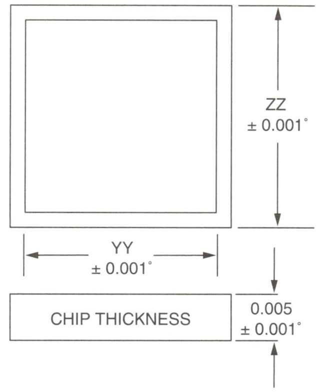
where:

SC = Silicon Capacitor

XXXX = Capacitance (pF)

YY = Square Contact Size (mils)

ZZ = Square Chip Size (mils)



Performance Data

Tests on typical MIS capacitors at L and S band show insertion loss to be 1/2 to 1/3 that of equivalent ceramic type capacitors, without any of the associated resonance problems. Power tests indicate that the only limitation is the actual breakdown voltage of the device (see data section). A typical insertion loss versus frequency graph is shown in Figure 1. This data is taken from an actual tests circuit with series mounted beam-lead or chip capacitors on a 50 Ω microstrip transmission line. The apparent higher loss at lower frequencies on the lower capacitance units is strictly due to the capacitive reactance of the capacitor.

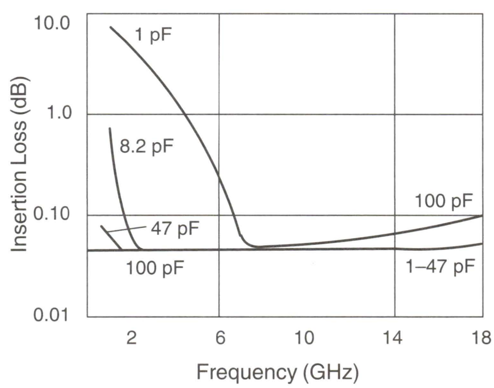
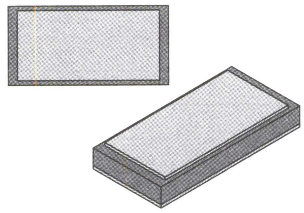


Figure 1. Typical Insertion Loss vs. Frequency (50 Ω System)

FET Chip Mounting Capacitors (MIS)

SKYWORKS

SC9016-000, SC9017-000



Features

- High Reliability
- Low Loss
- Operation Through 26 GHz
- Wide Temperature Operation

Description

The FET Chip Mounting Capacitor is an MIS thin film device which features small size and very high Q making it ideal for hybrid microelectronic applications at microwave frequencies.

The device has a dielectric composed of thermally grown silicon dioxide over which a layer of silicon nitride is deposited. This dielectric possesses a low temperature coefficient of capacitance, very high insulation resistance (typically greater than 1012 Ω), and low dissipation factor. The device also exhibits excellent long term stability making it suitable for high reliability applications. The capacitor has a high dielectric breakdown which permits the use of thin dielectrics resulting in large capacitance in a small area.

The plated gold metalization on the top face of the chip extends over most of the top surface. Gold wire can be readily thermocompression bonded to this metalization. The back side of the chip is also gold metallized and is readily solderable. Custom parts can be made having special values of capacitance or working voltage. Special metallization geometries or chip sizes can also be made available upon request.

The capacitor is designed to serve as a carrier for FET amplifier chips. As shown in Figure 1, when the FET chip is mounted directly onto the top metal pad of the capacitor, the gate and drain pads are on the same level as the top of the alumina circuit. Therefore, short wire lengths can be used to minimize the lead inductance. The SC9016 is a 10 mil thick chip designed for 15 mil thick alumina, while the SC9017 is a 20 mil thick chip designed for 26 mil thick alumina. When the FET chips is mounted directly onto the top metal pad of the capacitor, the source pads on the FET chip can be wire bonded to the same metal pads, which accomplishes RF bypass to ground via the capacitor.

Absolute Maximum Ratings

Characteristic	Value
Operating Temp Range (T_{OP})	-65 to +200°C
Storage Temp Range (T_{STG})	-65 to +200°C
Dielectric Withstanding Voltage	50 V

Electrical Specifications

Capacitance Range: 100 pF

Temperature Coefficient: 50 ppm/°C

Capacitance Tolerance: ±20%

Thermal Resistance:

SC9016: 10°C/W

SC9017: 12°C/W

Part Number	Outline Drawing Number	Thickness	For FET Chip Thickness	For Alumina Substrate Thickness
SC9016-000	411-801	0.010	0.005	0.015
SC9017-000	411-802	0.020	0.005	0.025

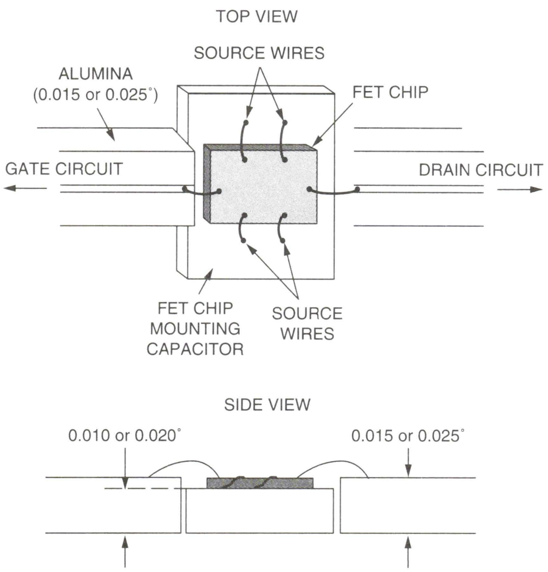


Figure 1. FET Chip Mounted on Top Metal Pad of Capacitor

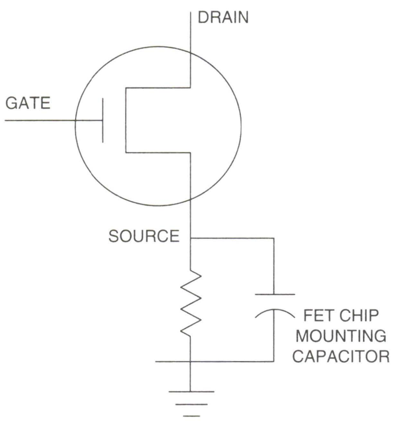
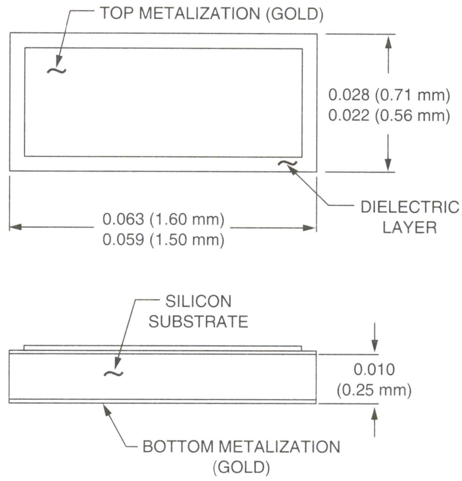
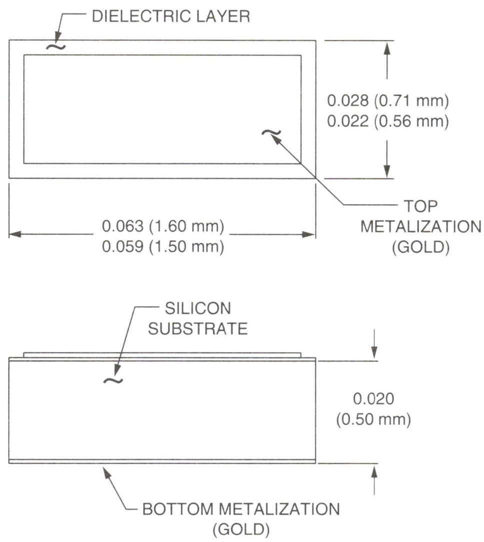


Figure 2. Schematic Diagram

411-801



411-802



Binary Trimming Capacitors (MIS)

SKYWORKS

SC9020-006, SC9020-018

Features

- High Reliability Silicon Oxide – Nitride Dielectric
- Low Loss, Typically 0.04 dB in a 50 Ω System
- Operation Through 26 GHz
- Wide Temperature Operation: -55°C to +200°C

Description

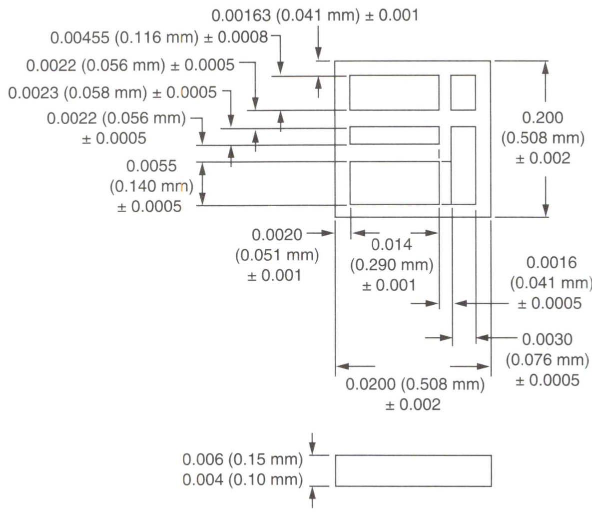
Four capacitors are provided on a single chip, binary weighted, to give 15 different values of capacitance by selective interconnection. This chip is designed for low inductance microwave applications and have the following features:

- Each individual capacitor is accessible from chip edge.
- Connection to two or more capacitors can always be made via a short ribbon at a central point.

The trimming capacitor is a MIS thin film device which has a dielectric composed of thermally grown silicon dioxide over which a layer of silicon nitride is deposited. This dielectric possesses a low temperature coefficient of capacitance, very high insulation resistance (typically greater than 1012 Ω), and low dissipation factor. The device also exhibits excellent long term stability making it suitable for high reliability applications. The capacitor has a high dielectric breakdown which permits the use of thin dielectrics resulting in large capacitance in a small area.

The plated gold metalization on the top face of the chip extends over most of the top surface. Gold wire can be readily thermocompression bonded to this metallization. The back side of the chip is also gold metallized and is readily solderable. Custom parts can be made having special values of capacitance or working voltage. Special metallization geometries or chip sizes can also be made available upon request.

428-801



Absolute Maximum Ratings

Characteristic	Value
Operating Temp Range (T_{OP})	-55 to +200°C
Storage Temp Range (T_{STG})	-55 to +200°C
Dielectric Withstanding Voltage	100 V

Electrical Specifications

Capacitance Tolerance: ±20%

Temperature Coefficient: 50 ppm/°C

Insulation Resistance: 10^5 Megohms Typical

Part Number	Capacitance (pF)	Maximum Available Capacitance (pF)	Outline Drawing Number
SC9020-006	0.25, 0.50, 1.0, 2.0	3.75	428-801
SC9020-018	1.0, 2.0, 4.0, 8.0	15	428-801

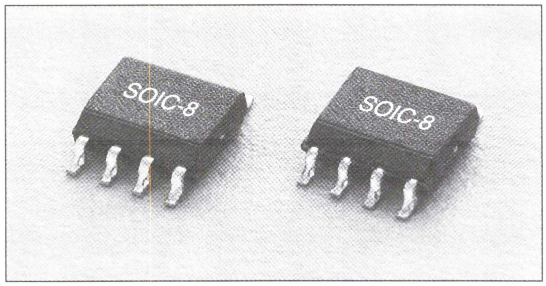
Power Divider/Combiners

Two-Way 0° Power Splitter Combiner 0.81–0.96 GHz

SKYWORKS

PD09-12

Features
- Low Cost
- Low Profile
- Available in Small SOIC-8 Package
- Tape & Reel

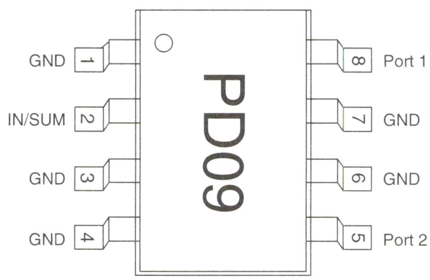


Description
The PD09-12 is a monolithic two-way in-phase hybrid junction tuned for the 0.81–0.96 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOIC-8 leaded surface mount package.

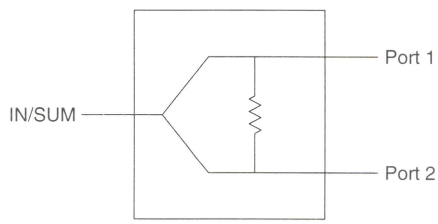
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	0.81		0.96	GHz
Insertion Loss Less 3 dB Split		0.4	0.6	dB
Isolation	20	25		dB
Input VSWR		1.2:1	1.4:1	
Output VSWR		1.3:1	1.5:1	
Amplitude Balance		±0.1	±0.2	dB
Phase Balance		±1.0	±3.0	Deg.

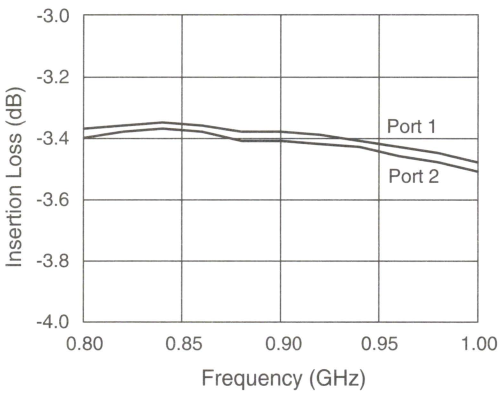
Pin Out



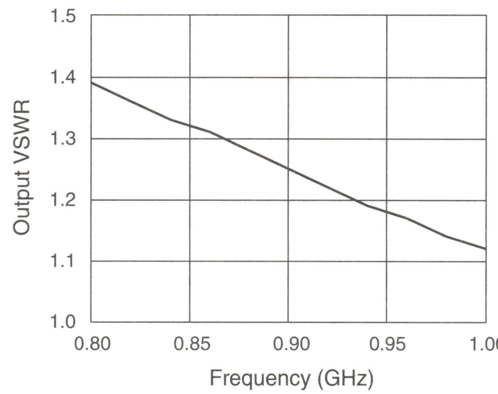
Block Diagram



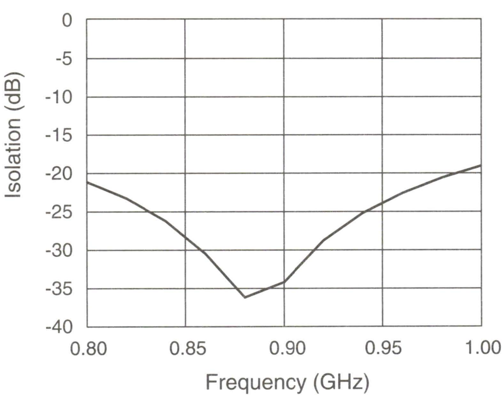
Typical Performance Data



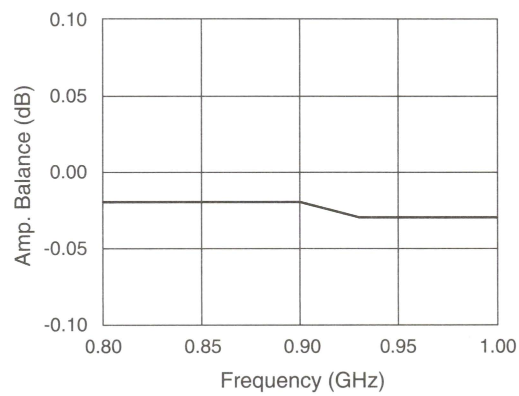
Insertion Loss vs. Frequency



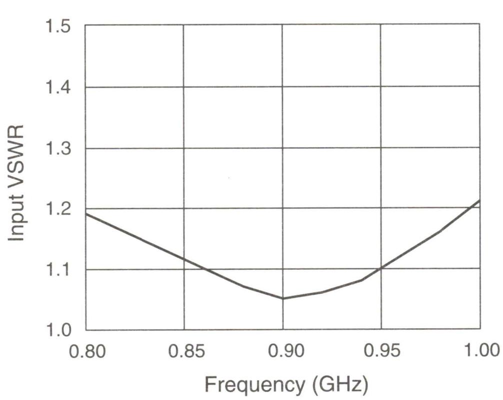
Output VSWR vs. Frequency



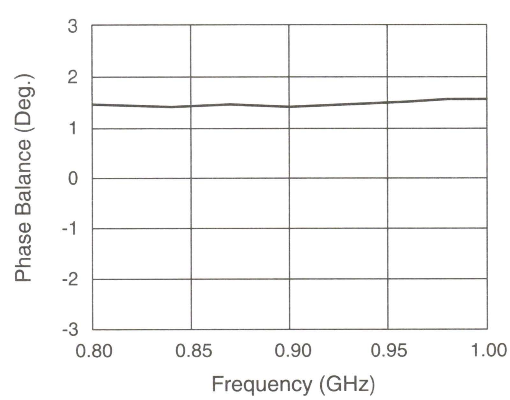
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



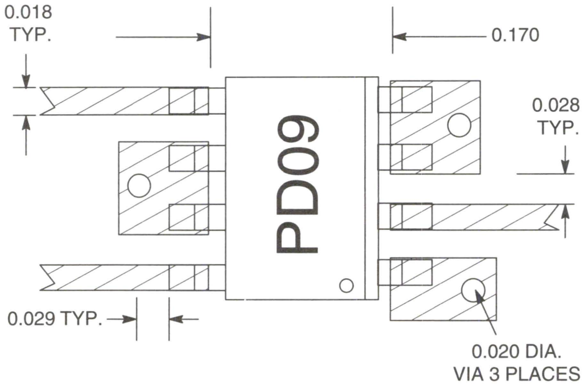
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.75 CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

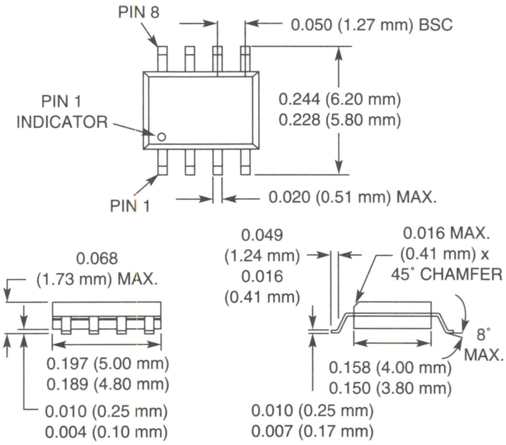
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOIC-8



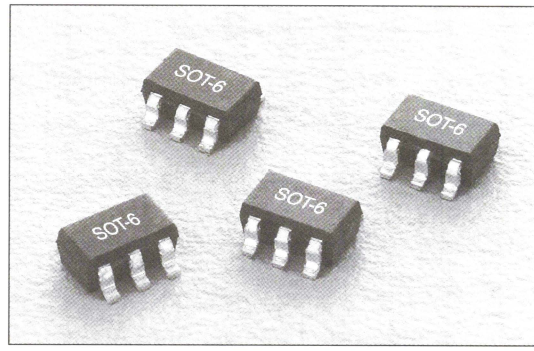
Two-Way 0° Power Splitter Combiner 0.81–0.96 GHz

SKYWORKS

PD09-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel



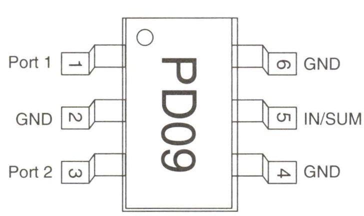
Description

The PD09-73 is a monolithic two-way in-phase hybrid junction tuned for the 0.81–0.96 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOT-6 lead surface mount package.

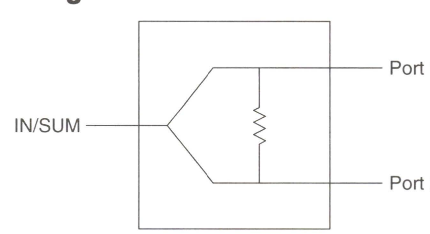
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	0.81		0.96	GHz
Insertion Loss Less 3 dB Split		0.4	0.6	dB
Isolation	18	25		dB
Input VSWR		1.2:1	1.4:1	
Output VSWR		1.3:1	1.5:1	
Amplitude Balance		±0.1	±0.2	dB
Phase Balance		±1.0	±3.0	Deg.

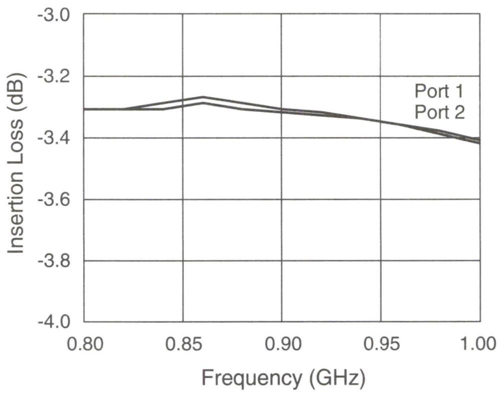
Pin Out



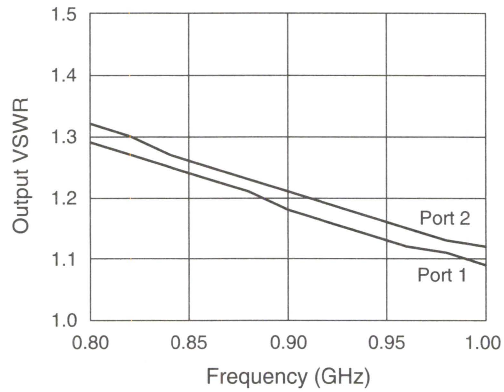
Block Diagram



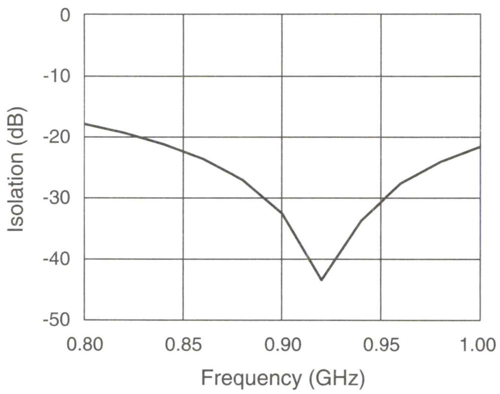
Typical Performance Data



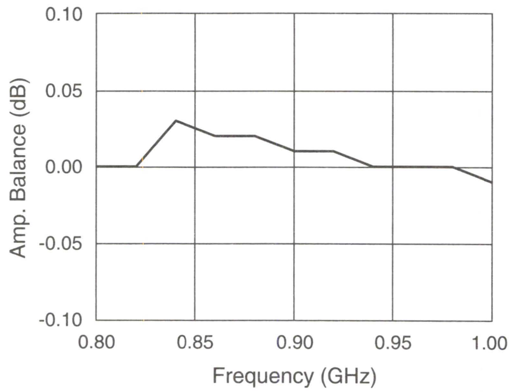
Insertion Loss vs. Frequency



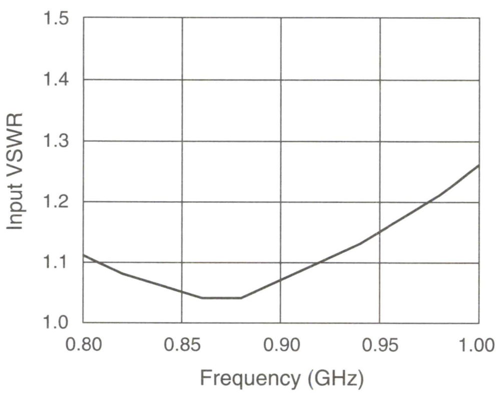
Output VSWR vs. Frequency



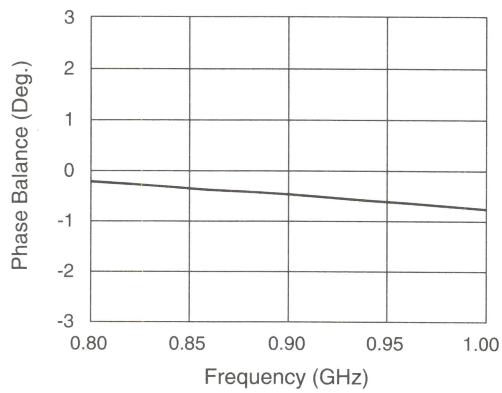
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



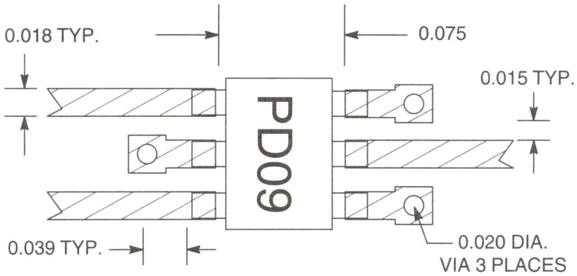
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	+1.5 W CW
Input Power[2]	+0.75 CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

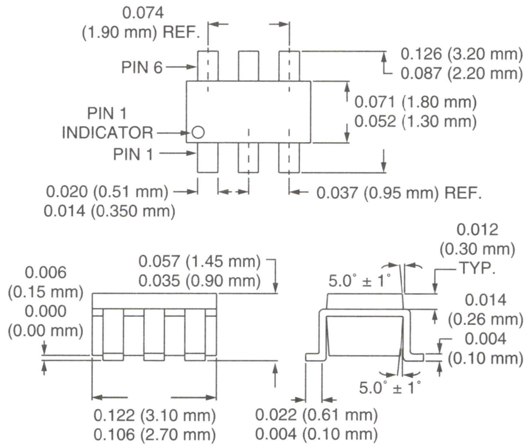
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOT-6



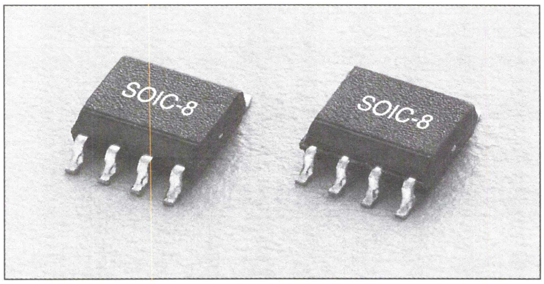
Two-Way 0° Power Splitter Combiner 1.42–1.66 GHz

SKYWORKS

PD15-12

Features

- Low Cost
- Low Profile
- Available in Small SOIC-8 Package
- Tape & Reel



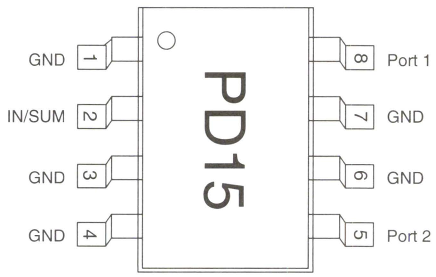
Description

The PD15-12 is a monolithic two-way in-phase hybrid junction tuned for the 1.42–1.66 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOIC-8 leaded surface mount package.

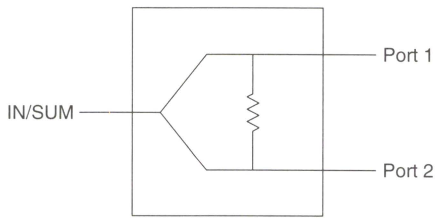
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.42		1.66	GHz
Insertion Loss Less 3 dB Split		0.4	0.6	dB
Isolation	20	23		dB
Input VSWR		1.2:1	1.5:1	
Output VSWR		1.2:1	1.4:1	
Amplitude Balance		±0.1	±0.2	dB
Phase Balance		±1.0	±3.0	Deg.

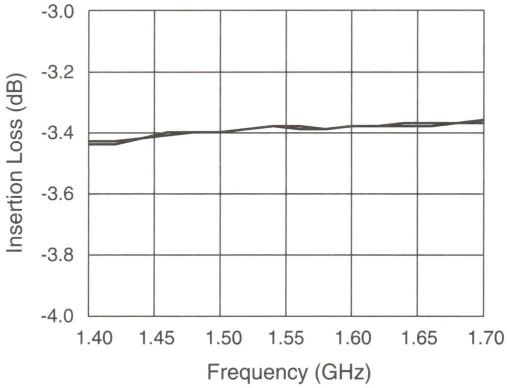
Pin Out



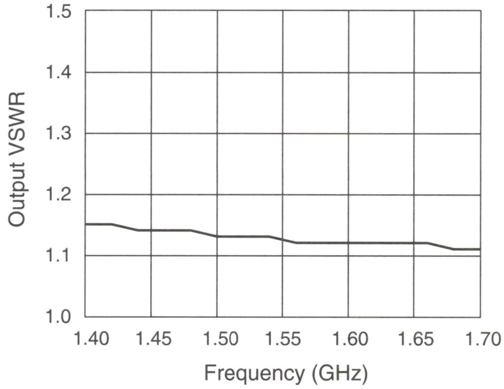
Block Diagram



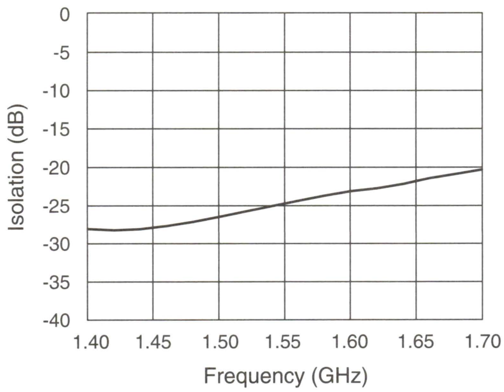
Typical Performance Data



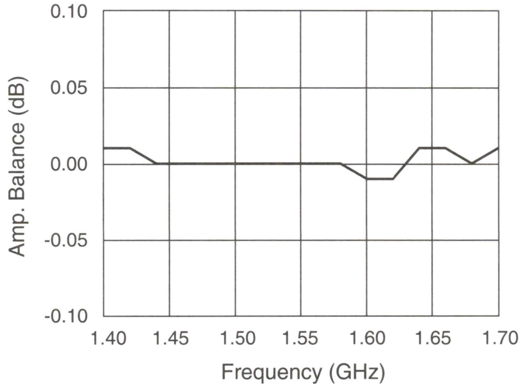
Insertion Loss vs. Frequency



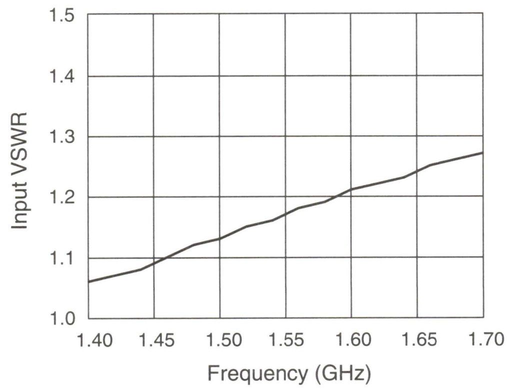
Output VSWR vs. Frequency



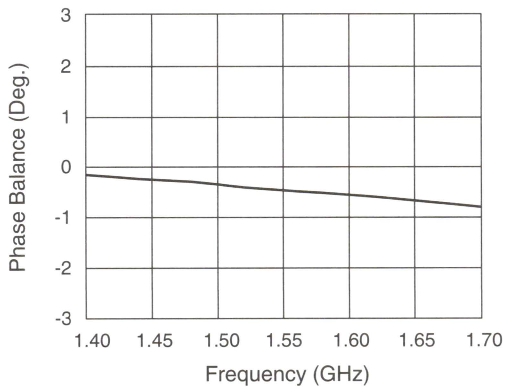
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



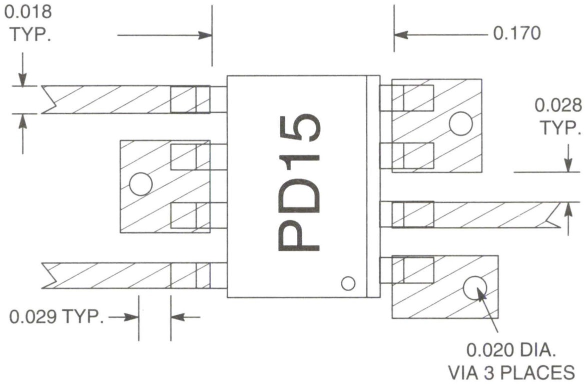
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.75 CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

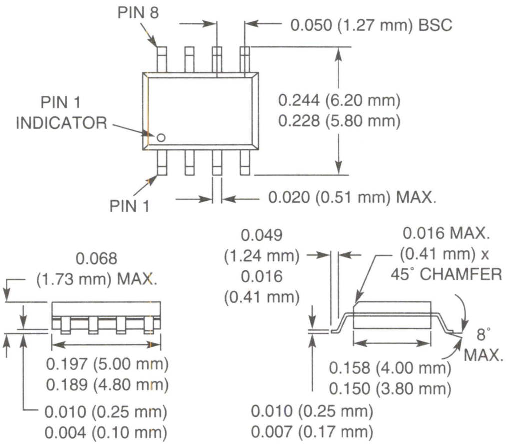
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOIC-8



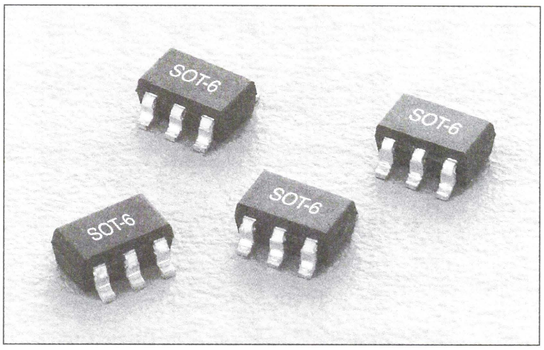
Two-Way 0° Power Splitter Combiner 1.42–1.66 GHz

SKYWORKS

PD15-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel



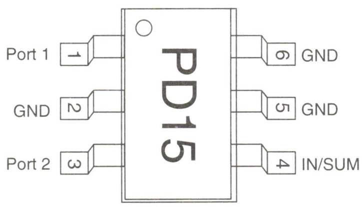
Description

The PD15-73 is a monolithic two-way in-phase hybrid junction tuned for the 1.42–1.66 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOT-6 lead surface mount package.

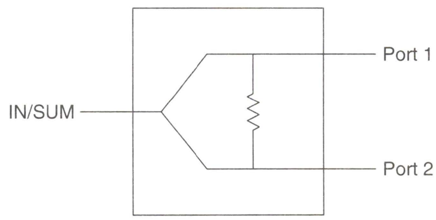
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.42		1.66	GHz
Insertion Loss Less 3 dB Split		0.4	0.6	dB
Isolation	18	23		dB
Input VSWR		1.2:1	1.5:1	
Output VSWR		1.2:1	1.4:1	
Amplitude Balance		±0.1	±0.2	dB
Phase Balance		±1.0	±3.0	Deg.

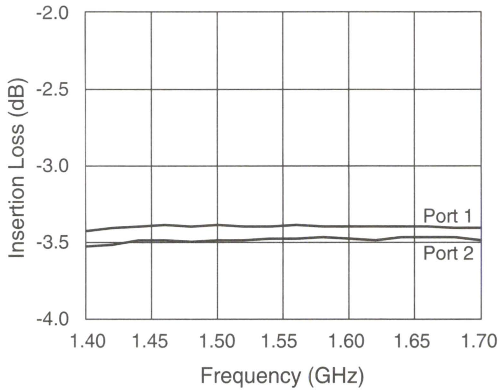
Pin Out



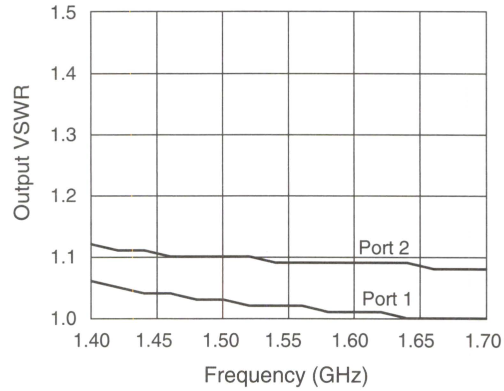
Block Diagram



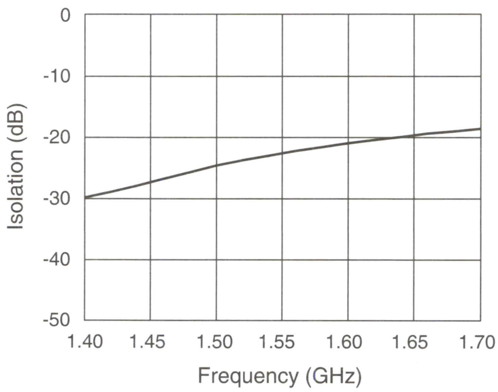
Typical Performance Data



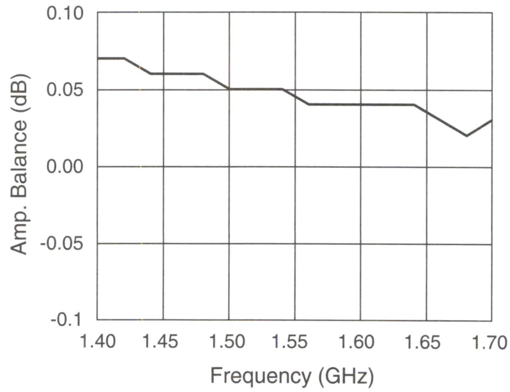
Insertion Loss vs. Frequency



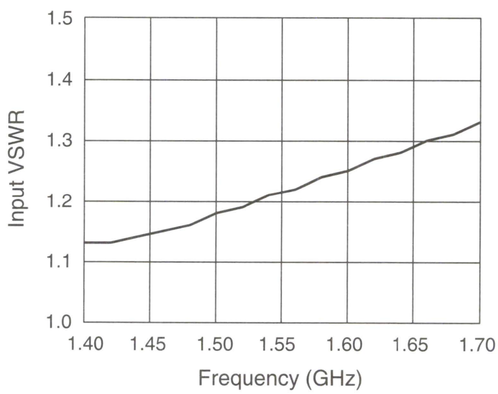
Output VSWR vs. Frequency



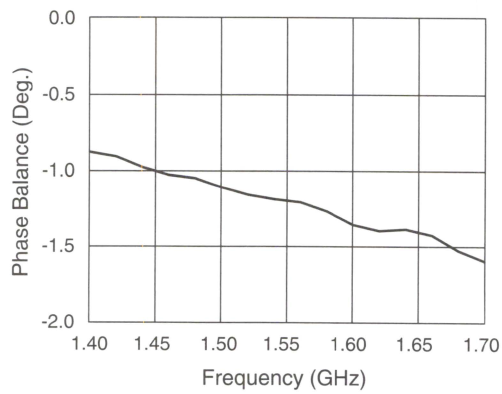
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



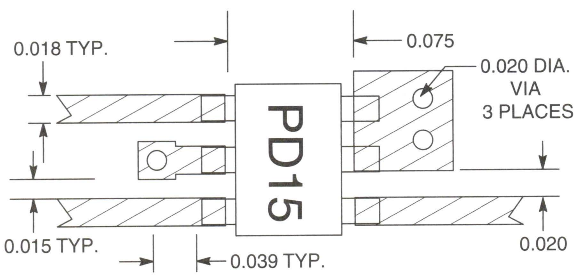
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.75 CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

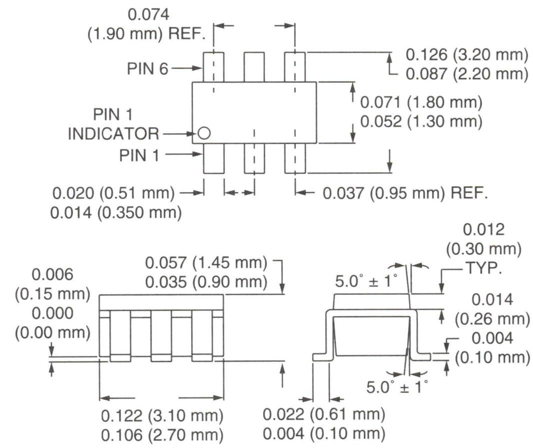
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOT-6



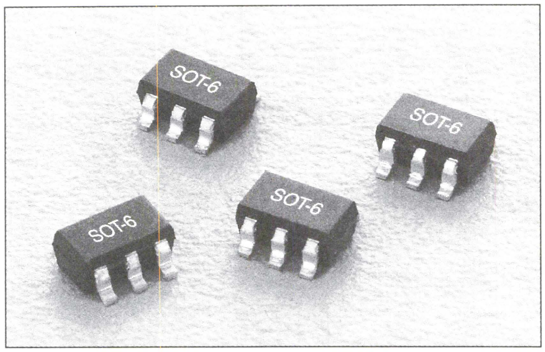
Two-Way 0° Power Splitter Combiner 1.42–1.66 GHz

SKYWORKS

PD16-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel
- Footprint Consistent with Other Parts in the "PD" Series



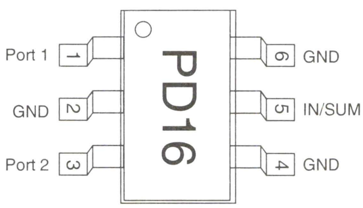
Description

The PD16-73 is a monolithic two-way in-phase hybrid junction tuned for the 1.42–1.66 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOT-6 lead surface mount package. The footprint of the PD16-73 is the same as the other power dividers in this package style and series to allow for consistent assembly setup.

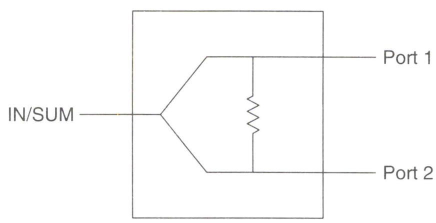
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.42		1.66	GHz
Insertion Loss Less 3 dB Split		0.4	0.6	dB
Isolation	18	23		dB
Input VSWR		1.2:1	1.5:1	
Output VSWR		1.2:1	1.4:1	
Amplitude Balance		±0.1	±0.2	dB
Phase Balance		±1.0	±3.0	Deg.

Pin Out

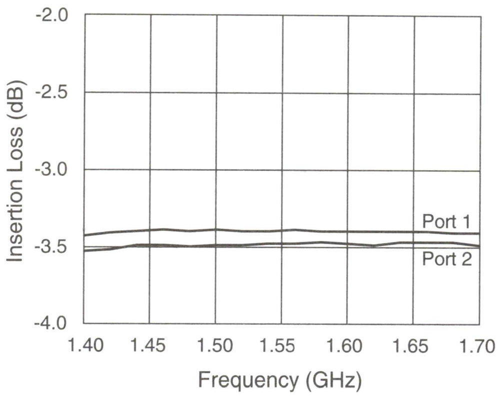


Block Diagram

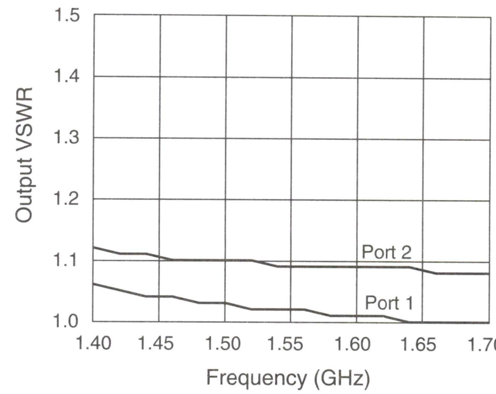


 Skyworks Solutions, Inc. **[781] 376-3000** • Fax **[781] 376-3100** • Email **sales@skyworksinc.com** • **www.skyworksinc.com**

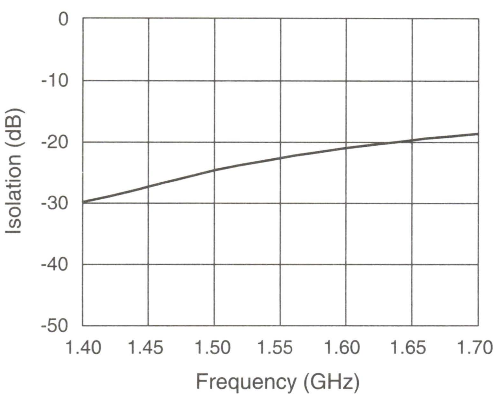
Typical Performance Data



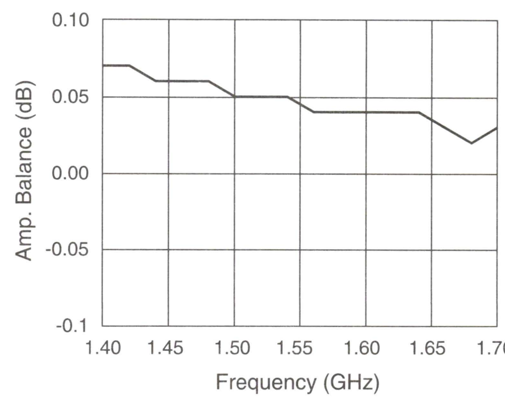
Insertion Loss vs. Frequency



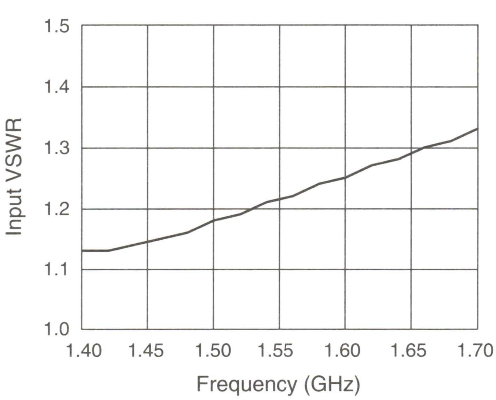
Output VSWR vs. Frequency



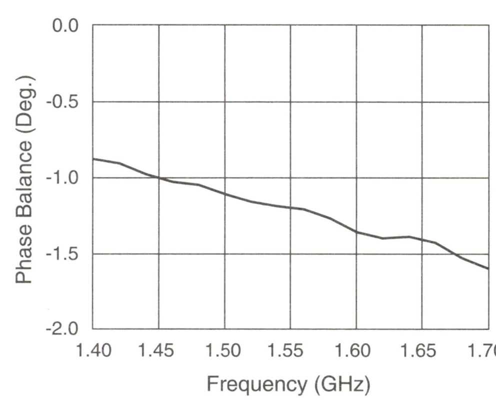
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



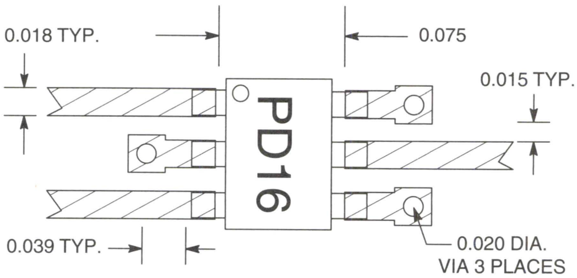
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.75 CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

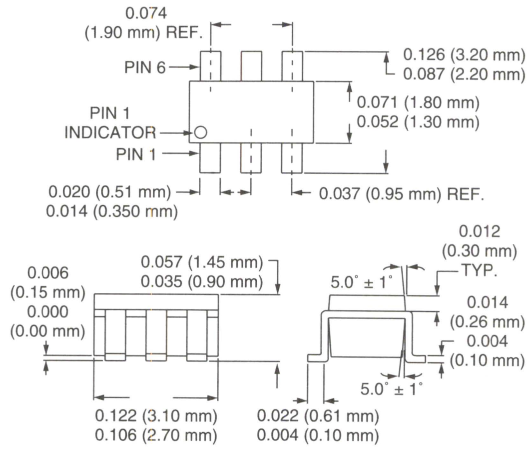
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOT-6



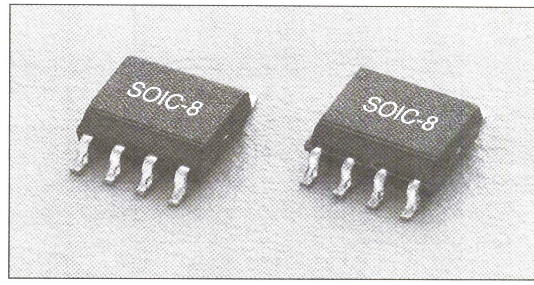
Two-Way 0° Power Splitter Combiner 1.71–1.99 GHz

SKYWORKS

PD18-12

Features

- Low Cost
- Low Profile
- Available in Small SOIC-8 Package
- Tape & Reel



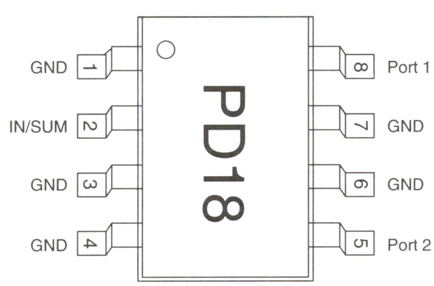
Description

The PD18-12 is a monolithic two-way in-phase hybrid junction tuned for the 1.71–1.99 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOIC-8 leaded surface mount package.

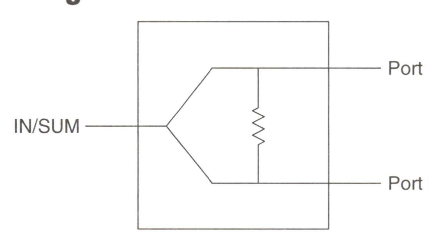
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.71		1.99	GHz
Insertion Loss Less 3 dB Split		0.4	0.6	dB
Isolation	20	23		dB
Input VSWR		1.3:1	1.5:1	
Output VSWR		1.2:1	1.4:1	
Amplitude Balance		±0.1	±0.2	dB
Phase Balance		±1.0	±3.0	Deg.

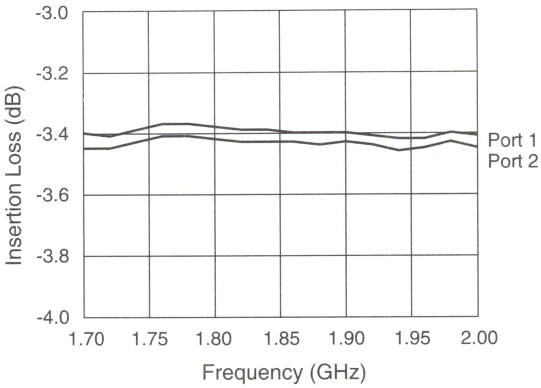
Pin Out



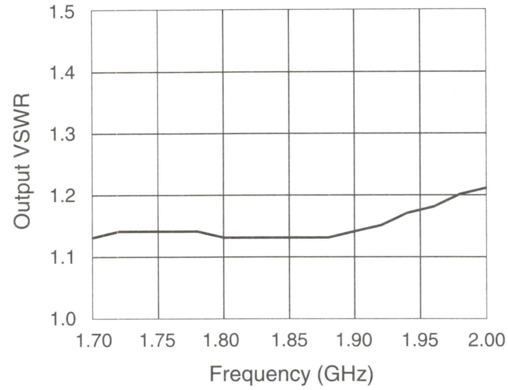
Block Diagram



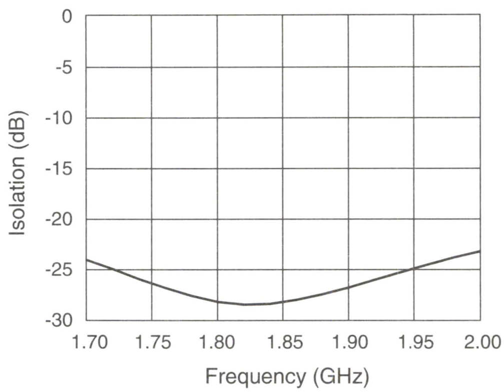
Typical Performance Data



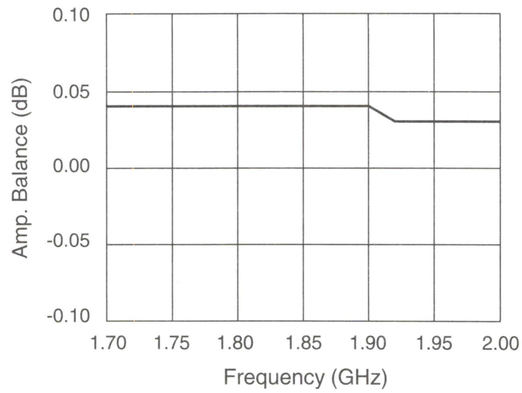
Insertion Loss vs. Frequency



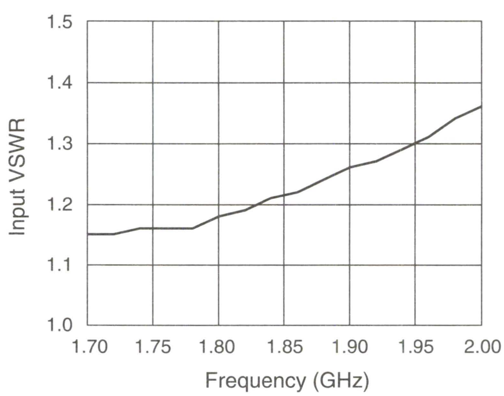
Output VSWR vs. Frequency



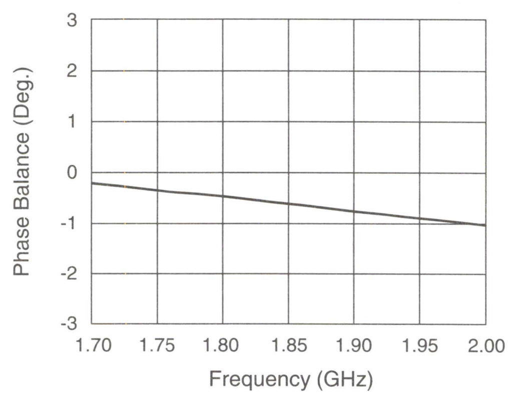
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



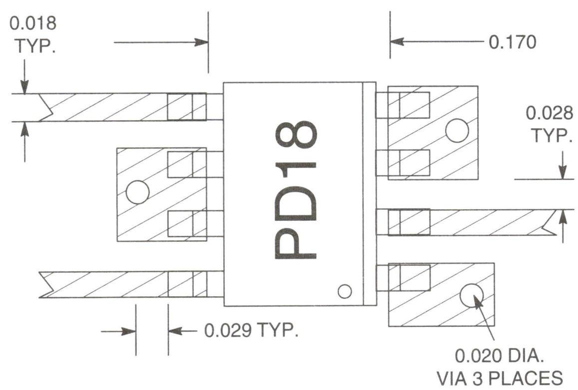
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.75 CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

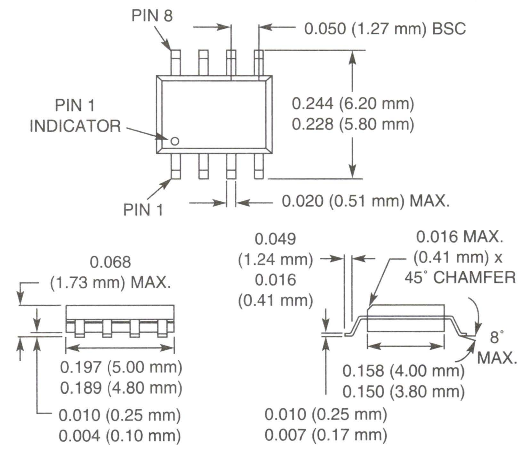
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOIC-8



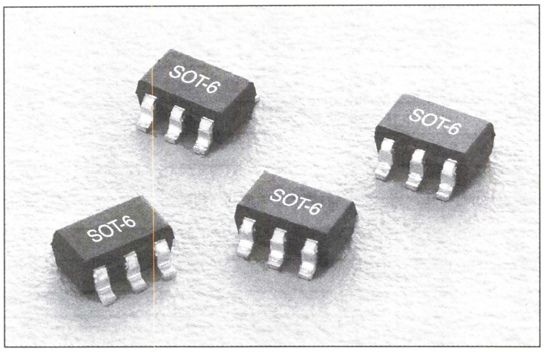
Two-Way 0° Power Splitter Combiner 1.71–1.99 GHz

SKYWORKS

PD18-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel



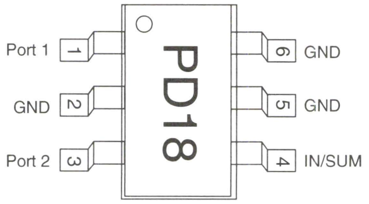
Description

The PD18-73 is a monolithic two-way in-phase hybrid junction tuned for the 1.71–1.99 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOT-6 lead surface mount package.

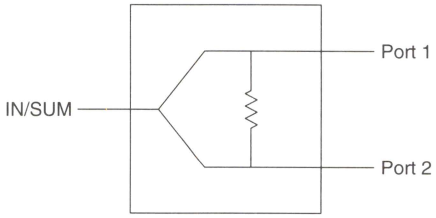
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.71		1.99	GHz
Insertion Loss Less 3 dB Split		0.4	0.6	dB
Isolation	18	23		dB
Input VSWR		1.3:1	1.5:1	
Output VSWR		1.2:1	1.4:1	
Amplitude Balance		±0.1	±0.2	dB
Phase Balance		±1.0	±3.0	Deg.

Pin Out

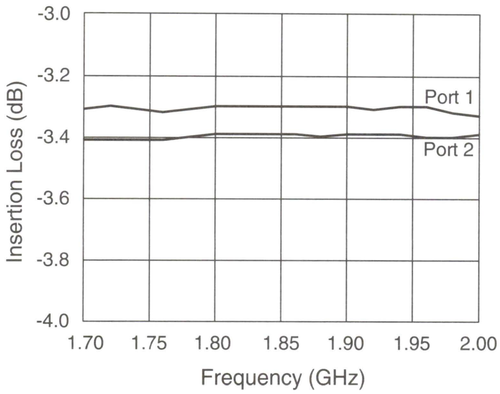


Block Diagram

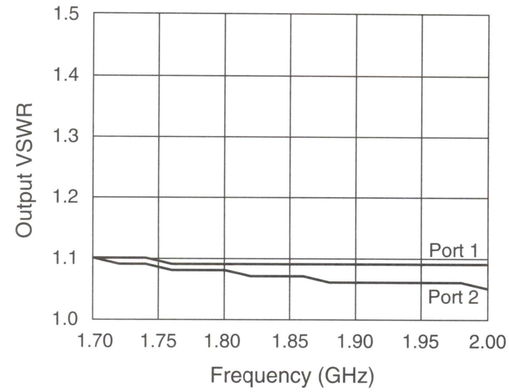


 Skyworks Solutions, Inc. **[781] 376-3000** • Fax **[781] 376-3100** • Email **sales@skyworksinc.com** • **www.skyworksinc.com**

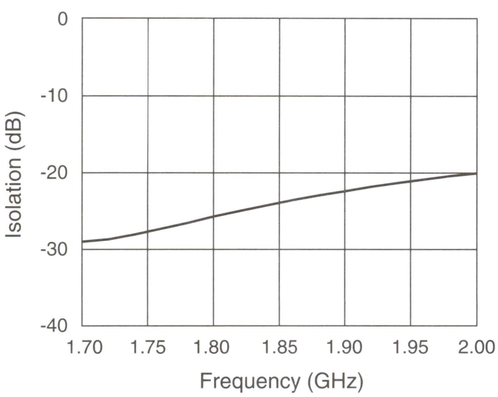
Typical Performance Data



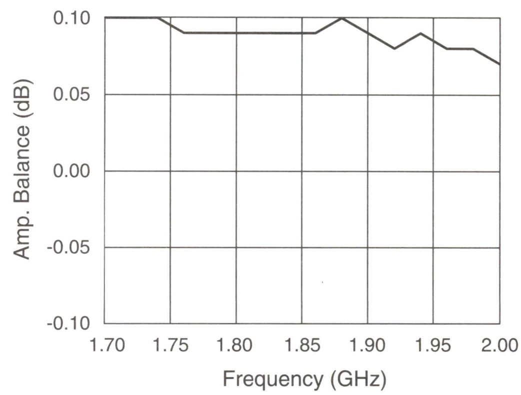
Insertion Loss vs. Frequency



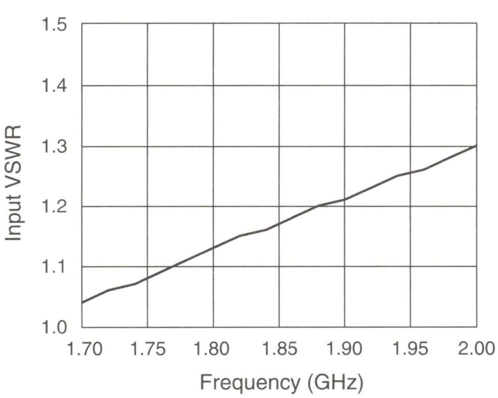
Output VSWR vs. Frequency



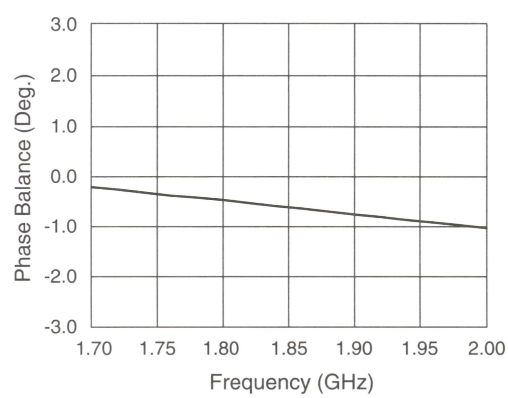
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



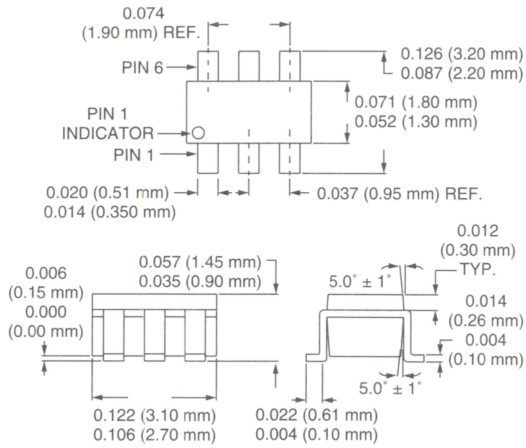
Phase Balance vs. Frequency

Absolute Maximum Ratings

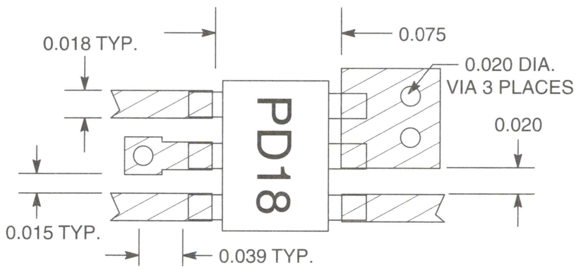
Characteristic	Value
Input Power[1]	+1.5 W CW
Input Power[2]	+0.75 CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

SOT-6



Recommended Board Layout



Material is 10 mil FR4

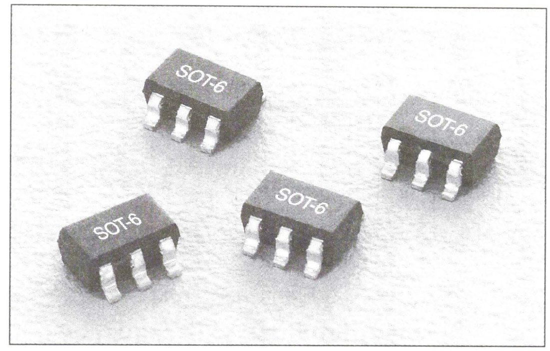
Two-Way 0° Power Splitter Combiner 1.71–1.99 GHz

SKYWORKS

PD19-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel
- Pin Compatible with PD09-73



Description

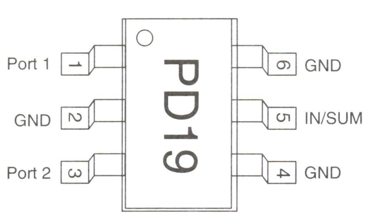
The PD19-73 is a monolithic two-way in-phase hybrid junction tuned for the 1.71–1.99 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOT-6 lead surface mount package.

The PD19-73 was designed to be pin-to-pin compatible with the PD09-73 Power Splitter/Combiner. This allows similar board layout for Power Splitter/Combiners in the frequency ranges covering 810–960 MHz and 1.7–1.99 GHz. The PD18-73 also covers 1.71–1.99 GHz but with different pin connections.

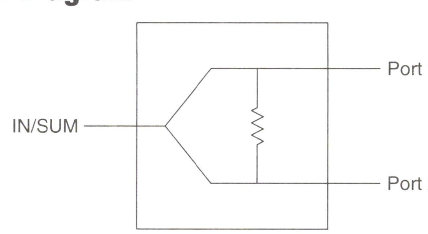
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.71		1.99	GHz
Insertion Loss Less 3 dB Split		0.55	0.70	dB
Isolation	20	25		dB
Input VSWR		1.3:1	1.5:1	
Output VSWR		1.2:1	1.4:1	
Amplitude Balance		±0.1	±0.2	dB
Phase Balance		±1.0	±3.0	Deg.

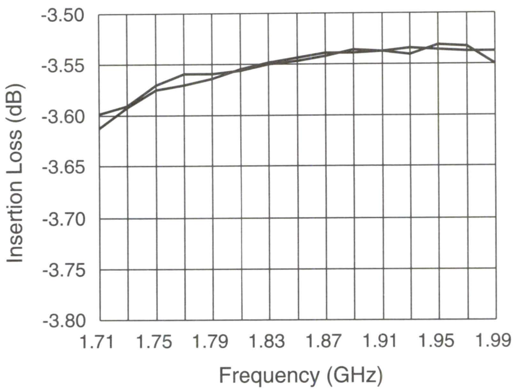
Pin Out



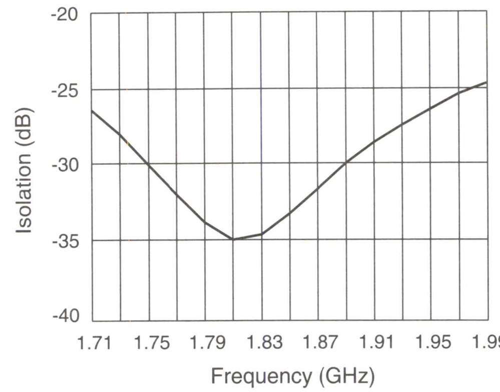
Block Diagram



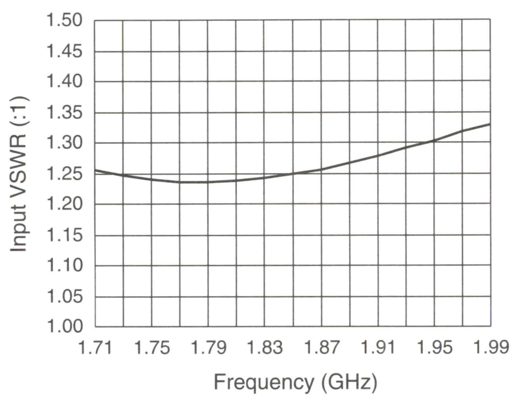
Typical Performance Data



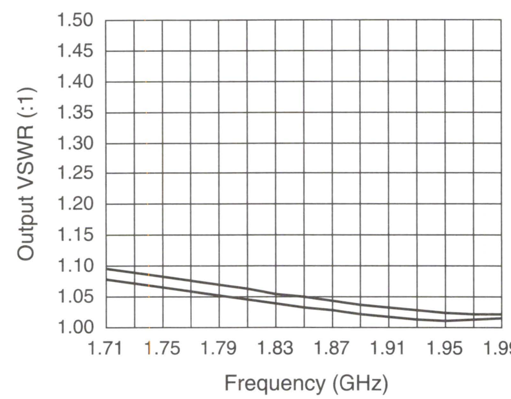
Insertion Loss vs. Frequency



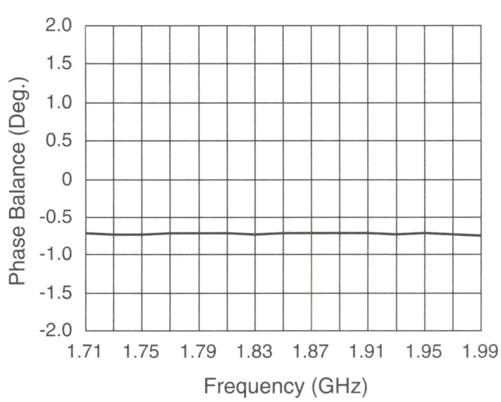
Isolation vs. Frequency



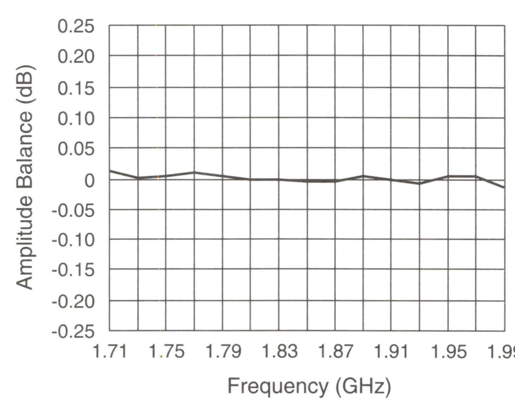
Input VSWR vs. Frequency



Output VSWR vs. Frequency



Phase Balance vs. Frequency



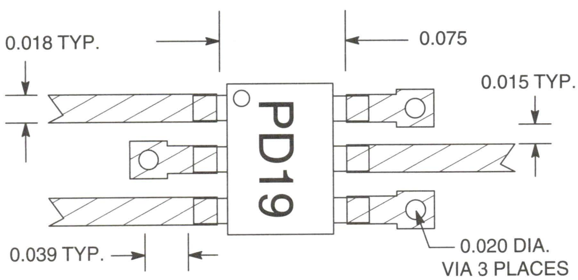
Amplitude Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	+1.5 W CW
Input Power[2]	+0.75 CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

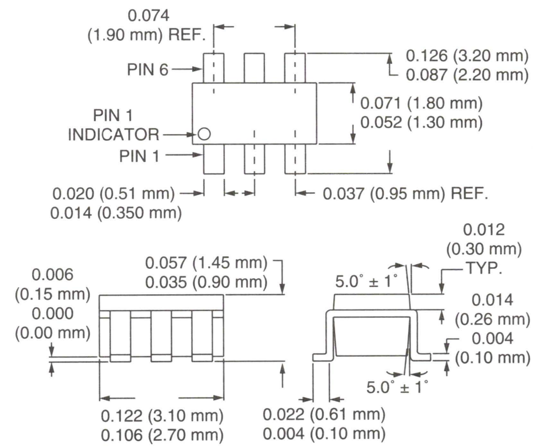
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOT-6



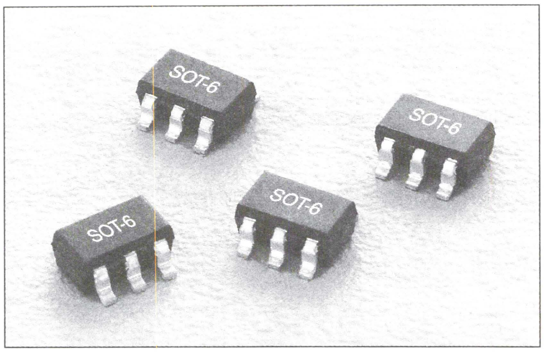
Two-Way Power Splitter 2.1–2.3 GHz

SKYWORKS

PD22-73

Features

- Low Cost
- Low Profile
- Small SOT-6 Package
- Tape & Reel



Description

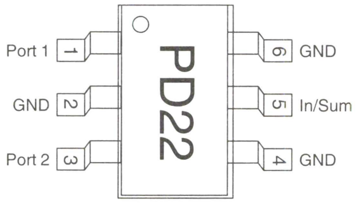
The PD22-73 is a 50 Ω, in-phase combiner/splitter tuned for the 2.1–2.3 GHz band. The monolithic circuitry is 100% passive and offers low loss, high isolation and exceptional phase/amplitude balance. It is available in the SOT-6 leaded surface mount package.

Electrical Specifications at 25°C, 50 Ω System

Parameter	Min.	Typ.	Max.	Unit
Frequency	2.1		2.3	GHz
Insertion Loss Less 3 dB Split		0.55	0.7	dB
Isolation[1]	15.0	18.00		dB
Input VSWR		1.5:1	2.0:1	
Output VSWR		1.1:1	1.3:1	
Amplitude Balance		±0.10	±0.2	dB
Phase Balance		±1.00	±3.0	Deg.

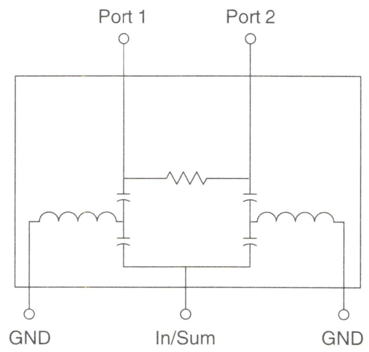
[1] Isolation can be increased to 23 dB with an external 5.6 nH inductor from in/sum port to ground.

Pin Out

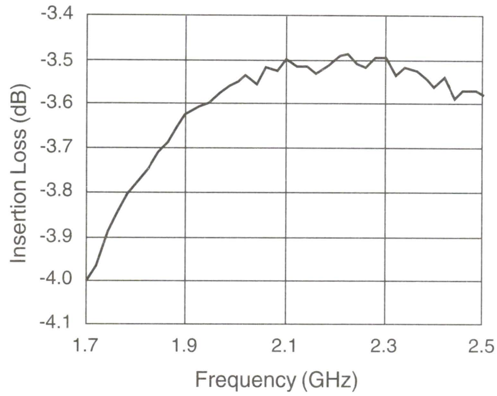


PD22 is the part marking.

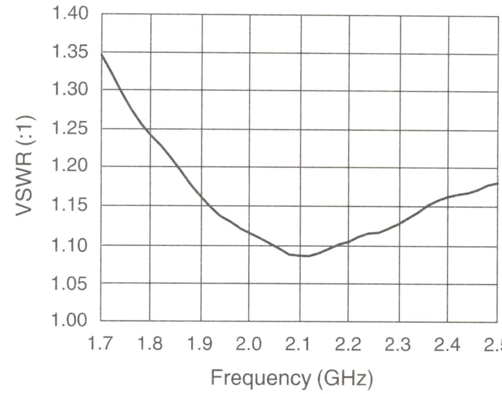
Block Diagram



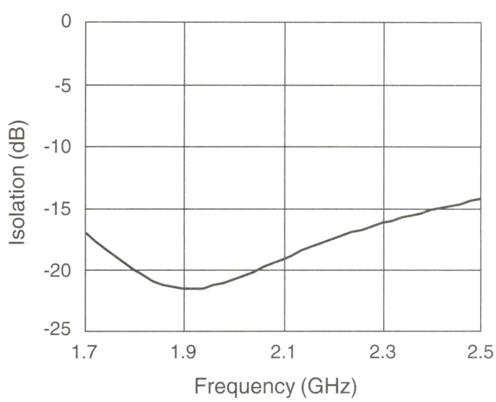
Typical Performance Data



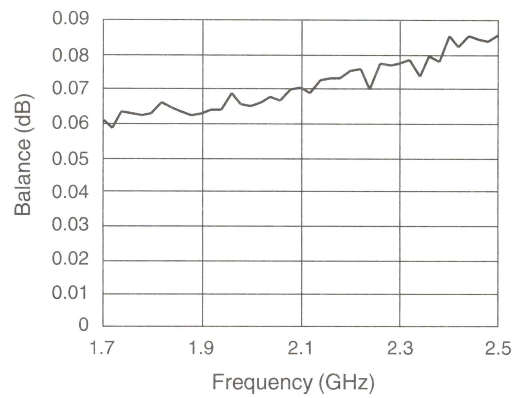
Insertion Loss vs. Frequency



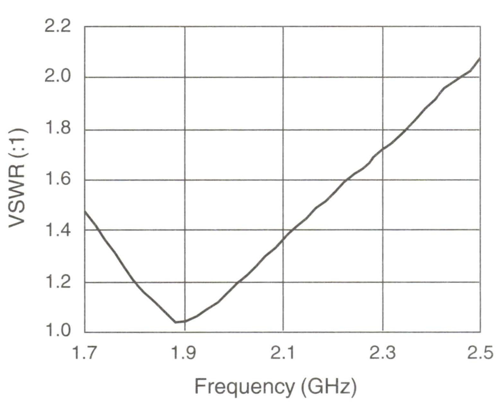
Output VSWR vs. Frequency



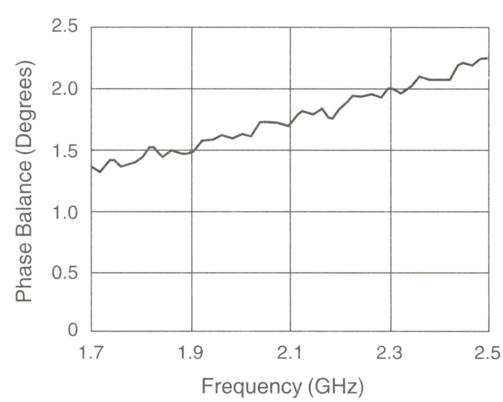
Isolation vs. Frequency



Amplitude Balance vs. Frequency

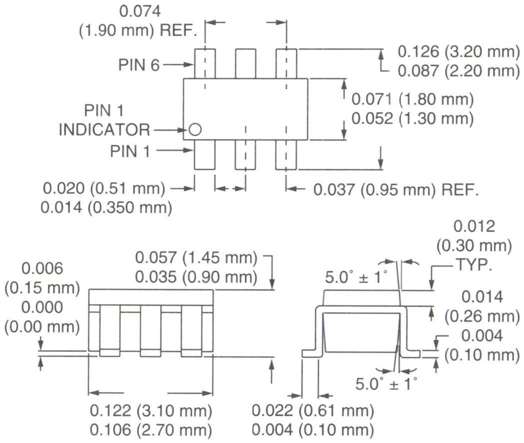


Input VSWR vs. Frequency

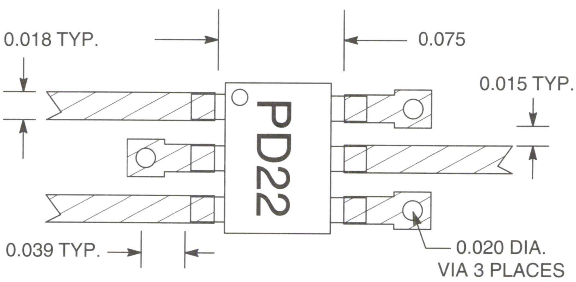


Phase Balance vs. Frequency

SOT-6



Recommended Board Layout



Material is 10 mil FR4

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	1.5 W CW
Input Power[2]	0.75 W CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

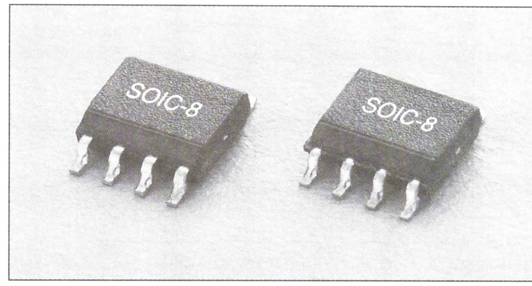
Four-Way 0° Power Splitter Combiner 0.81–0.96 GHz

SKYWORKS

PD4W09-12

Features

- Low Cost
- Low Profile
- Available in Small SOIC-8 Package
- Tape & Reel



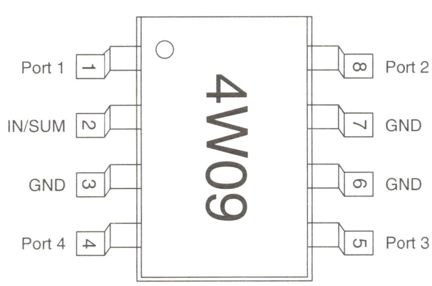
Description

The PD4W09-12 is a monolithic four-way in-phase hybrid junction tuned for the 0.81–0.96 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOIC-8 leaded surface mount package.

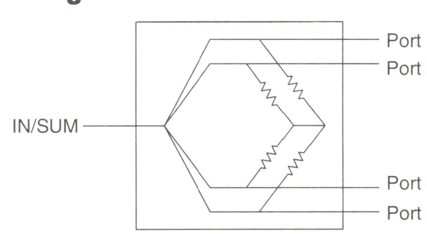
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	0.81		0.96	GHz
Insertion Loss Less 6 dB Split		1.3	1.5	dB
Isolation	20	23		dB
Input VSWR		1.2:1	1.5:1	
Output VSWR		1.2:1	1.5:1	
Amplitude Balance		±0.4	±0.6	dB
Phase Balance		±6	±8	Deg.

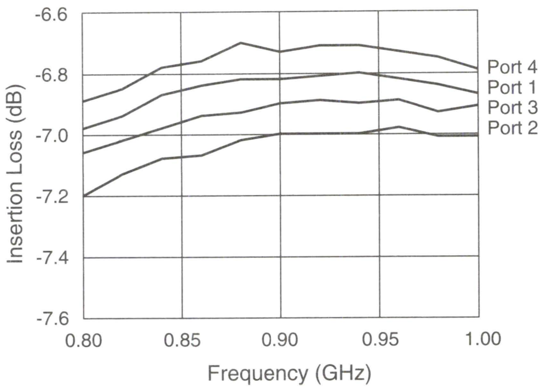
Pin Out



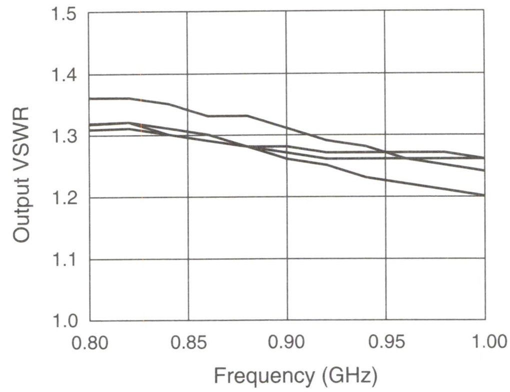
Block Diagram



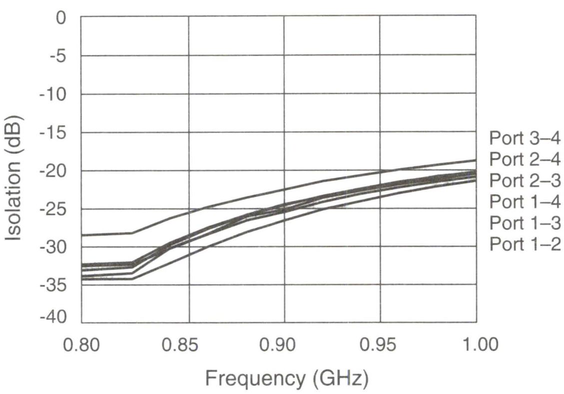
Performance Data



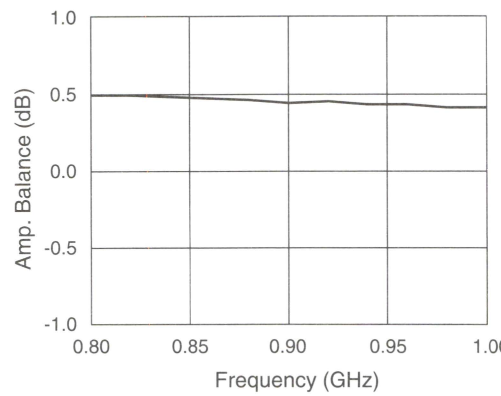
Insertion Loss vs. Frequency



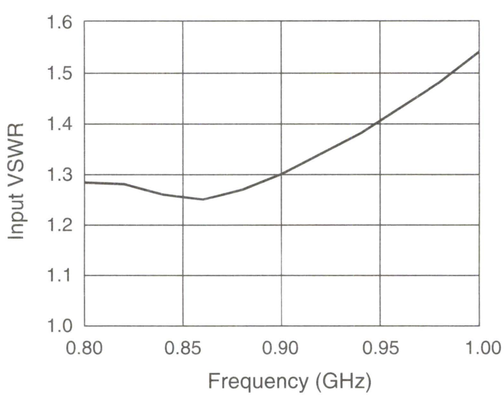
Output VSWR vs. Frequency



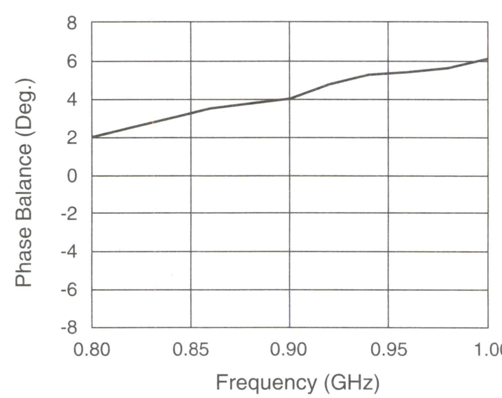
Isolation vs. Frequency



Amp. Balance vs. Frequency



Input VSWR vs. Frequency



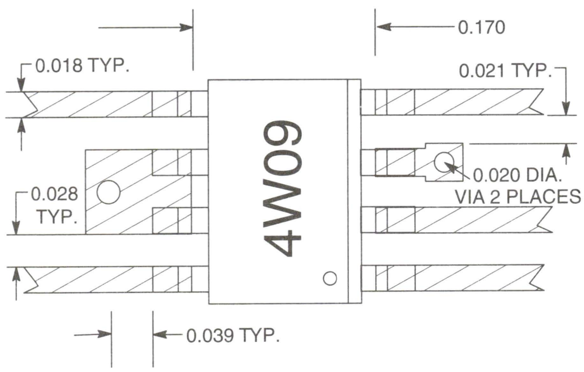
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	+1.5 W CW
Input Power[2]	+0.375 CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

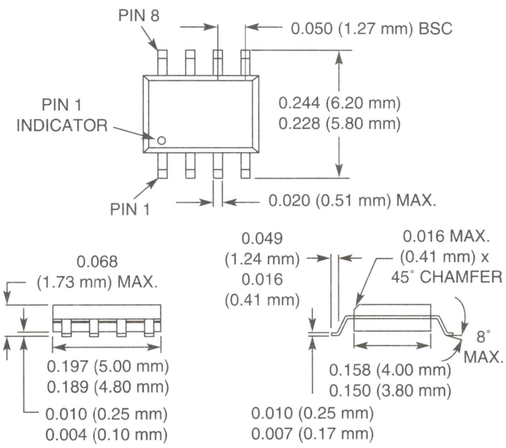
1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOIC-8



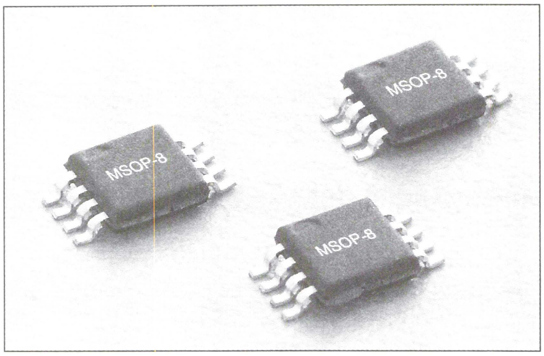
Four-Way 0° Power Splitter Combiner 0.81–0.96 GHz

SKYWORKS

PD4W09-59

Features

- Low Cost
- Low Profile
- Available in Small MSOP-8 Package
- Tape & Reel



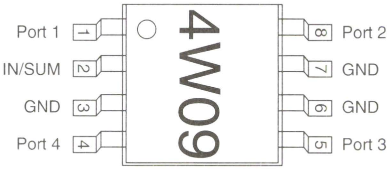
Description

The PD4W09-59 is a monolithic four-way in-phase hybrid junction tuned for the 0.81–0.96 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the MSOP-8 leaded surface mount package.

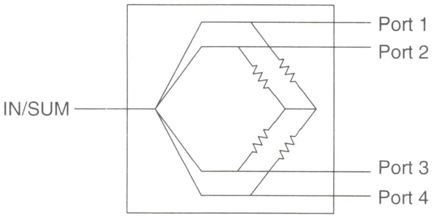
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	0.81		0.96	GHz
Insertion Loss Less 6 dB Split		1.3	1.5	dB
Isolation	20	23		dB
Input VSWR		1.2:1	1.5:1	
Output VSWR		1.2:1	1.5:1	
Amplitude Balance		±0.4	±0.6	dB
Phase Balance		±6	±8	Deg.

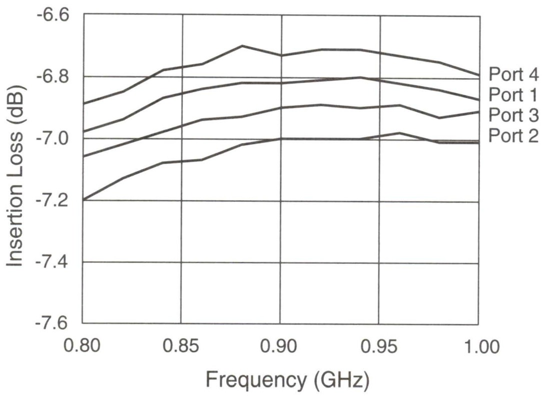
Pin Out



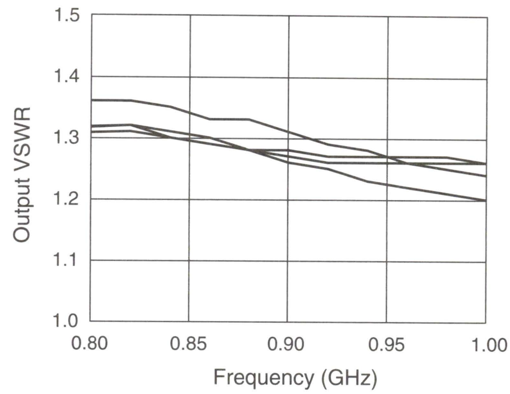
Block Diagram



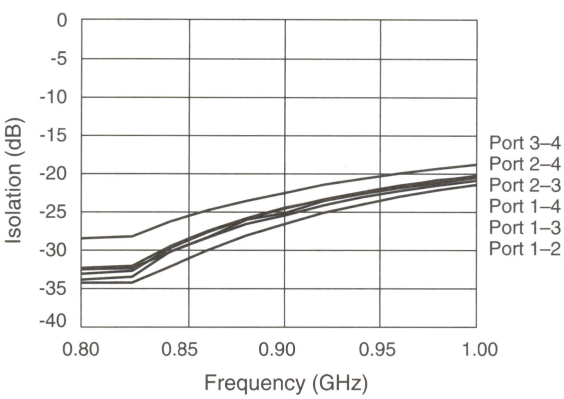
Typical Performance Data



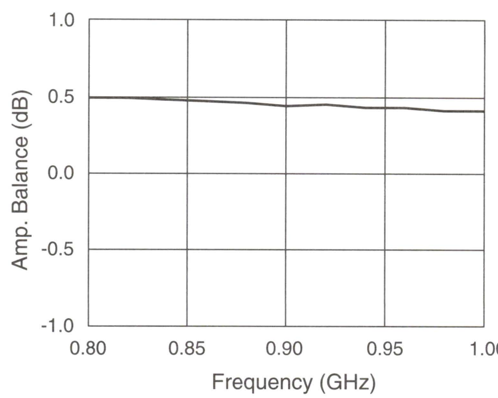
Insertion Loss vs. Frequency



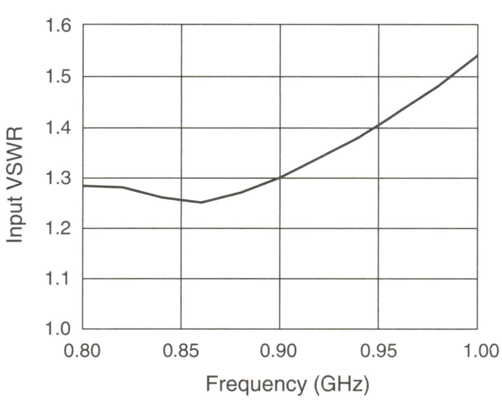
Output VSWR vs. Frequency



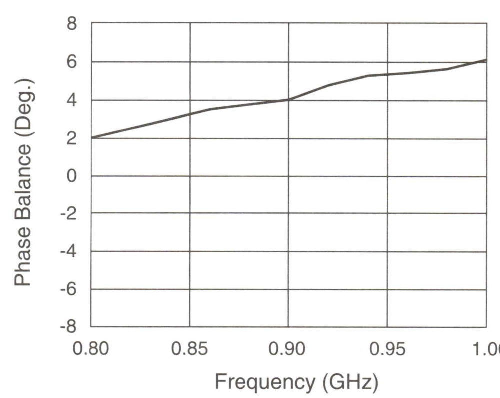
Isolation vs. Frequency



Amp. Balance vs. Frequency

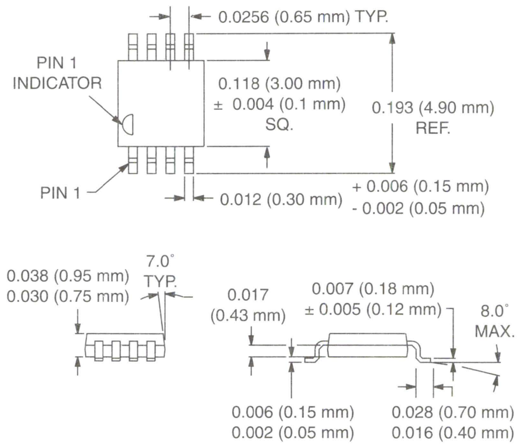


Input VSWR vs. Frequency

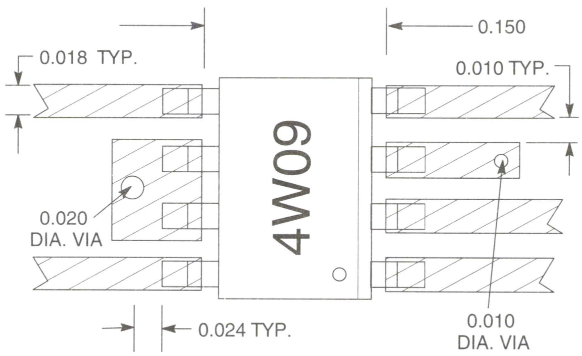


Phase Balance vs. Frequency

MSOP-8



Recommended Board Layout



Material is 10 mil FR4

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	+1.5 W CW
Input Power[2]	+0.375 CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

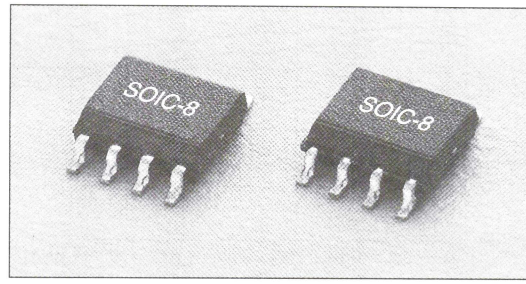
Four-Way 0° Power Splitter Combiner 1.71–1.99 GHz

SKYWORKS

PD4W18-12

Features

- Low Cost
- Low Profile
- Available in Small SOIC-8 Package
- Tape & Reel



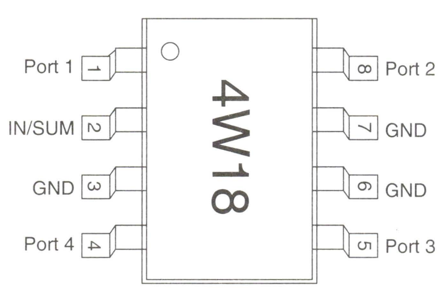
Description

The PD4W18-12 is a monolithic four-way in-phase hybrid junction tuned for the 1.71–1.99 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the SOIC-8 leaded surface mount package.

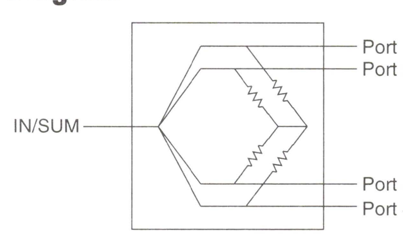
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.71		1.99	GHz
Insertion Loss Less 6 dB Split		0.7	1.0	dB
Isolation	18	25		dB
Input VSWR		1.6:1	1.8:1	
Output VSWR		1.2:1	1.5:1	
Amplitude Balance		±.3	±.4	dB
Phase Balance		±5.0	±9.0	Deg.

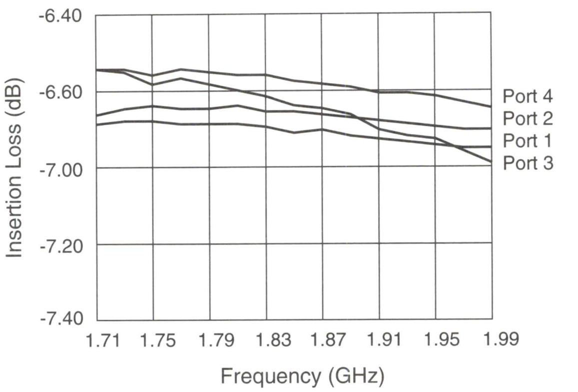
Pin Out



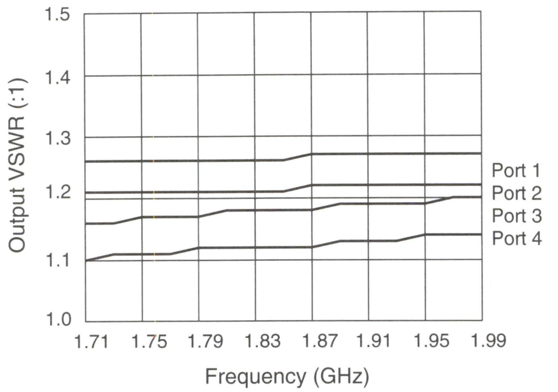
Block Diagram



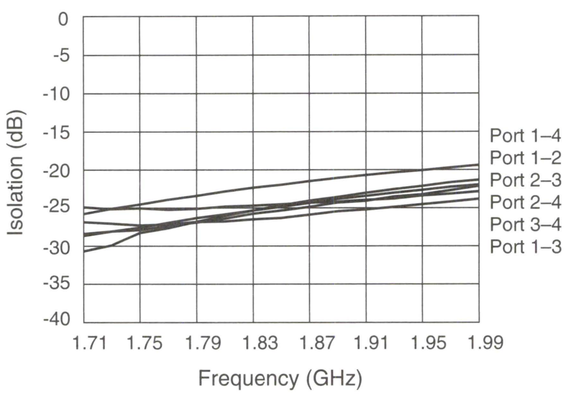
Typical Performance Data



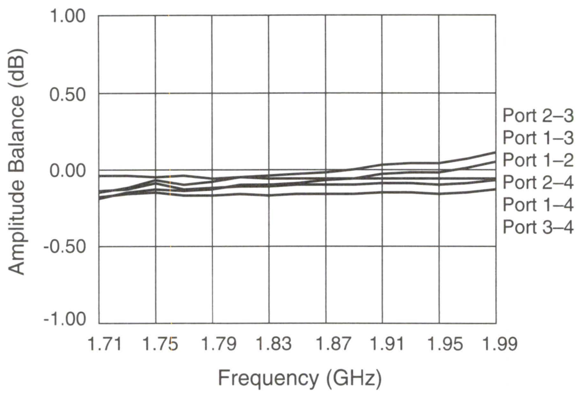
Insertion Loss vs. Frequency



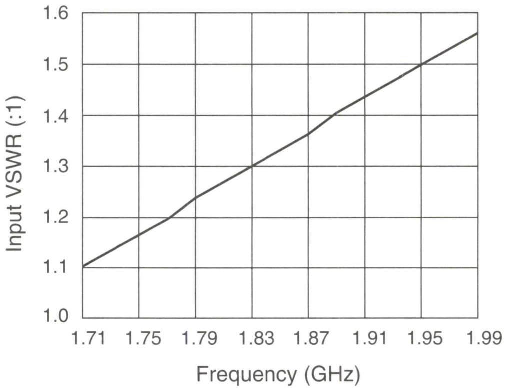
Output VSWR vs. Frequency



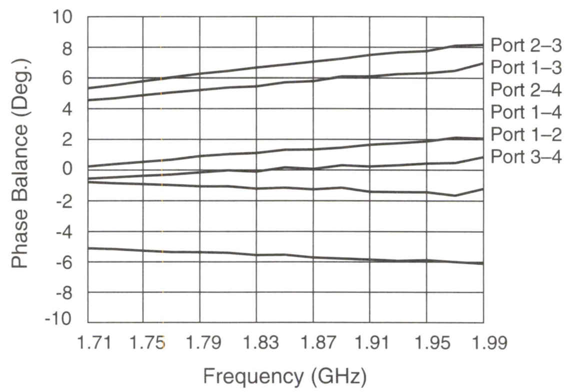
Isolation vs. Frequency



Amplitude Balance vs. Frequency



Input VSWR vs. Frequency



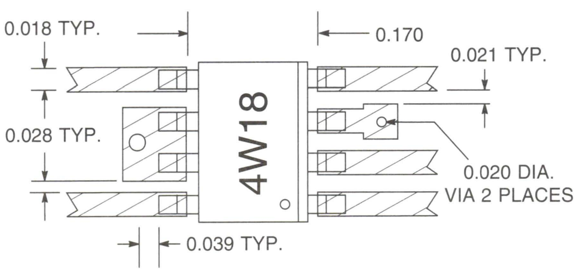
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	+1.5 W CW
Input Power[2]	+0.375 CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-60°C to +150°C

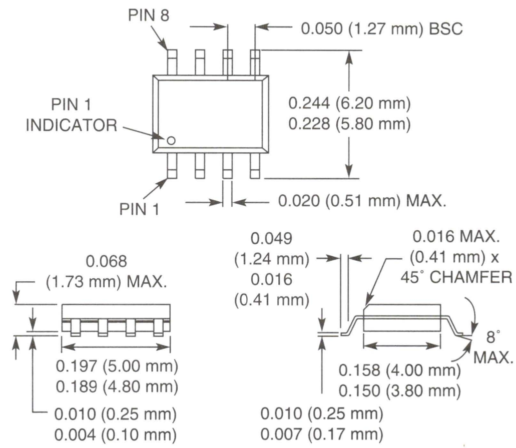
1. When used as a power divider with a 2.0:1 Max. VSWR on all ports.
2. When used as a power combiner with 2.0:1 Max. VSWR on all ports.

Board Layout



Material is 10 mil FR4

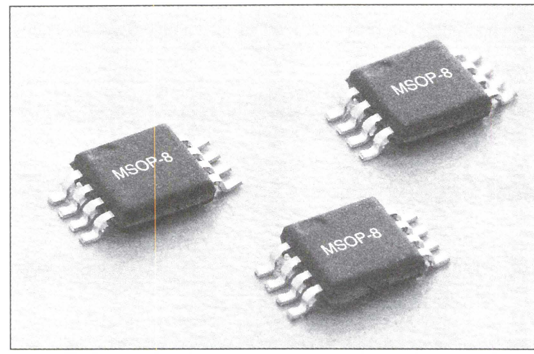
SOIC-8



Four-Way 0° Power Splitter Combiner 1.71–1.99 GHz

SKYWORKS

PD4W18-59



Features

- Low Cost
- Low Profile
- Available in Small MSOP-8 Package
- Tape & Reel

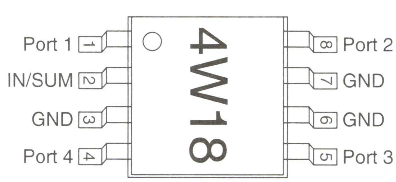
Description

The PD4W18-59 is a monolithic four-way in-phase hybrid junction tuned for the 1.71–1.99 GHz band. It offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance. It is available in the MSOP-8 leaded surface mount package.

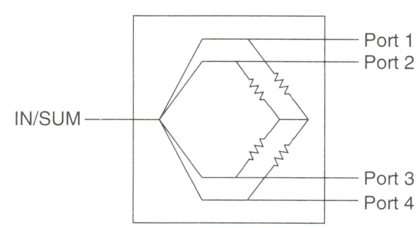
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.71		1.99	GHz
Insertion Loss Less 6 dB Split		0.7	1.2	dB
Isolation	20	25		dB
Input VSWR		1.3:1	1.6:1	
Output VSWR		1.3:1	1.6:1	
Amplitude Balance		±.3	±.4	dB
Phase Balance		±5.0	±8.0	Deg.

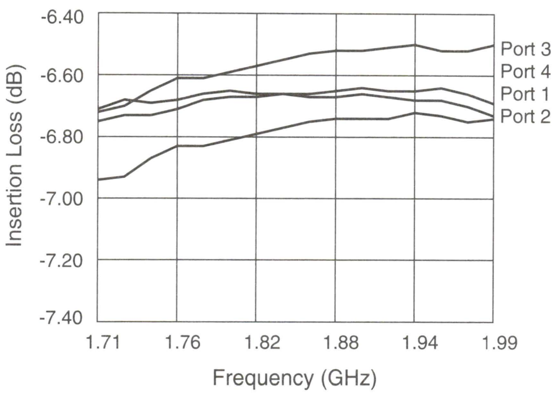
Pin Out



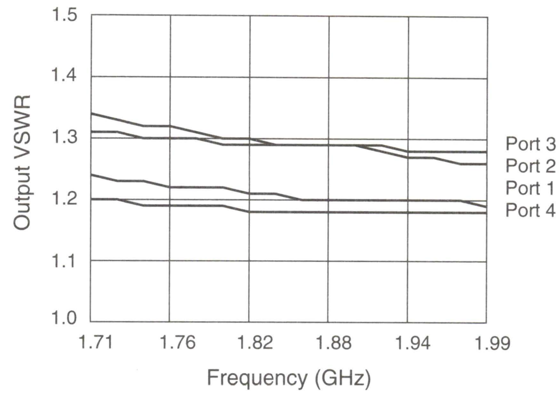
Block Diagram



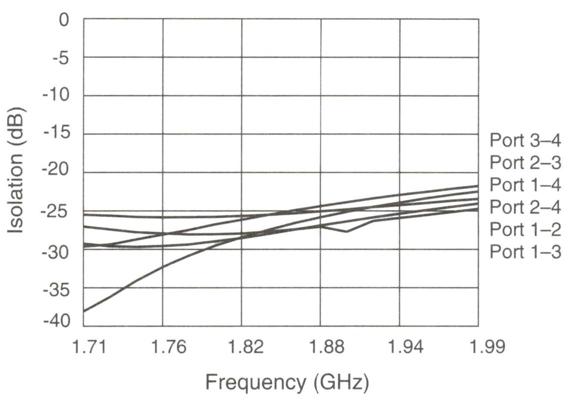
Typical Performance Data



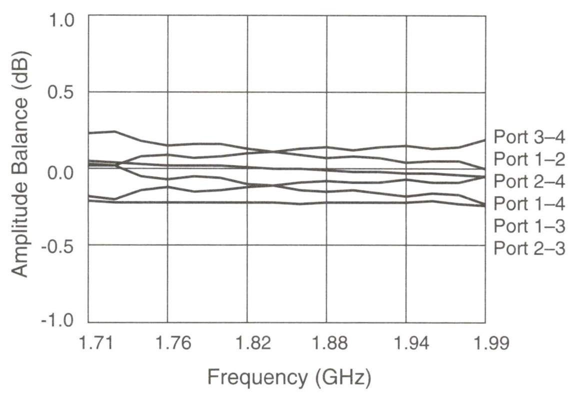
Insertion Loss vs. Frequency



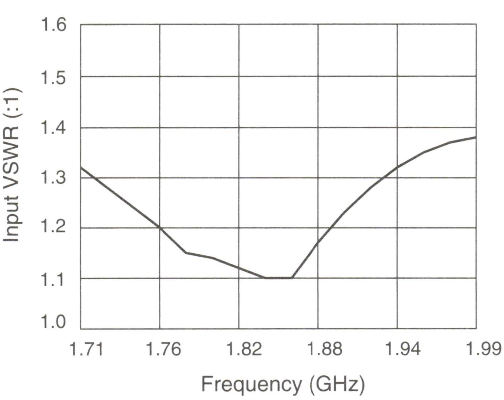
Output VSWR vs. Frequency



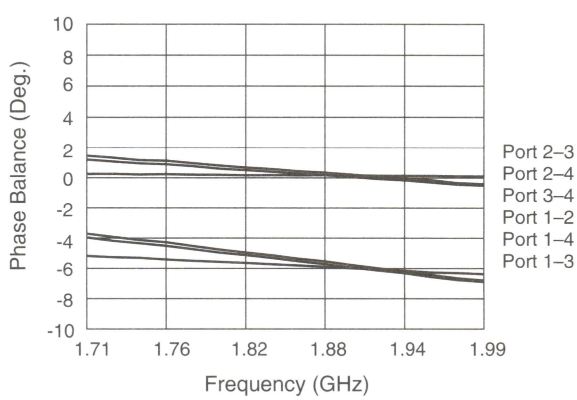
Isolation vs. Frequency



Amplitude Balance vs. Frequency



Input VSWR vs. Frequency



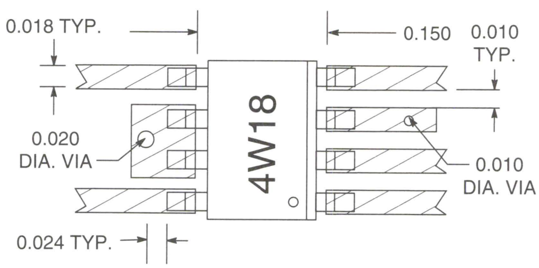
Phase Balance vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	+1.5 W CW
Input Power[2]	+0.375 CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-60°C to +150°C

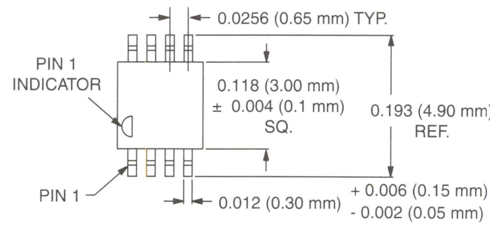
1. When used as a power divider with a 2.0:1 Max. VSWR on all ports.
2. When used as a power combiner with 2.0:1 Max. VSWR on all ports.

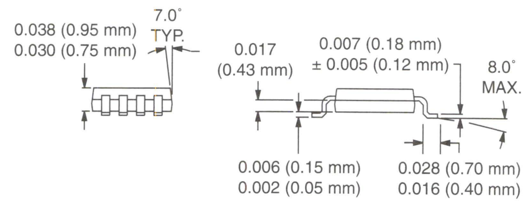
Board Layout



Material is 10 mil FR4

MSOP-8





Directional Couplers

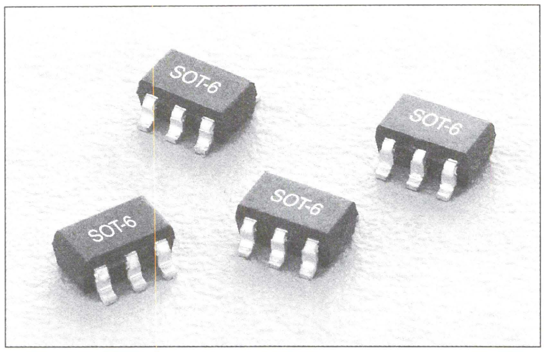
Directional Coupler 0.81–0.96 GHz

SKYWORKS

DC08-73

Features

- Low Cost
- Low Profile
- Small SOT-6 Package
- Tape & Reel



Description

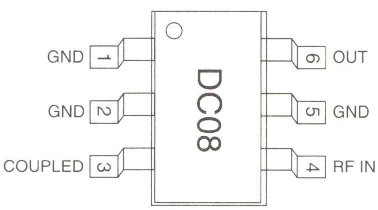
The DC08-73 is a monolithic directional coupler tailored to the 0.81–0.96 GHz band. It offers low loss, good isolation, good input/output matching and exceptional coupling repeatability. It may be used at higher frequencies when stronger coupling is required. It is available in the SOT-6 leaded surface mount package.

Electrical Specifications at 25°C

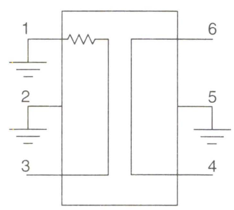
Parameter	Min.	Typ.	Max.	Unit
Frequency	0.81		0.96	GHz
Insertion Loss[1]		.35	.45	dB
Isolation	21	22		dB
Input VSWR		1.05:1	1.3:1	
Output VSWR		1.05:1	1.3:1	
Coupling	14	15	16	dB
Coupled Port VSWR		1.2:1	1.3:1	

1. Coupling loss included.

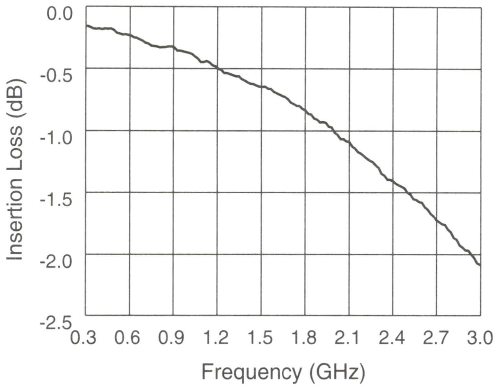
Pin Out



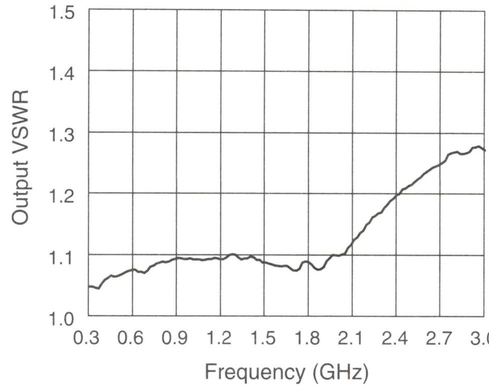
Block Diagram



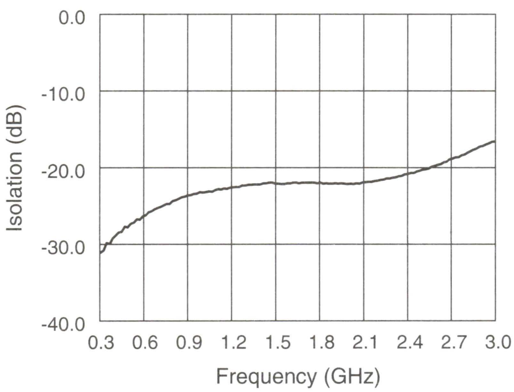
Typical Performance Data



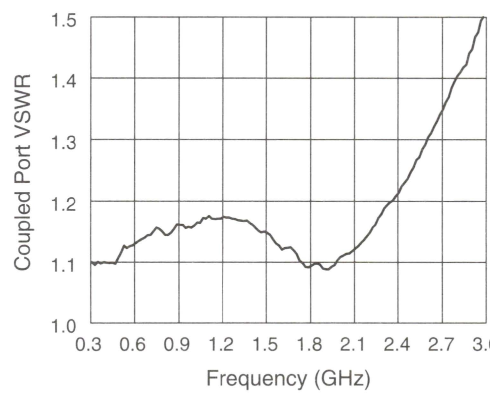
Insertion Loss vs. Frequency



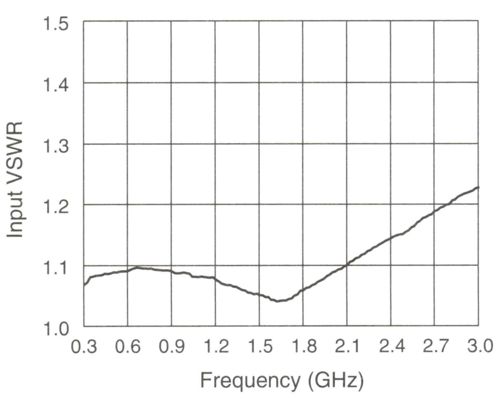
Output VSWR vs. Frequency



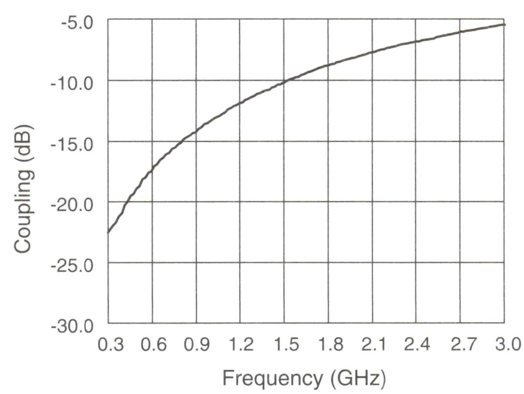
Isolation vs. Frequency



Coupled Port VSWR vs. Frequency



Input VSWR vs. Frequency



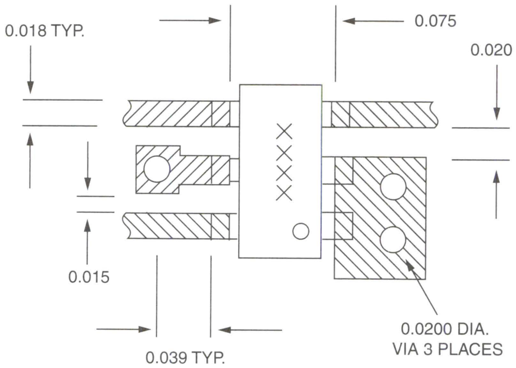
Coupling vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power	+4 W
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Electrostatic Discharge	+125 V

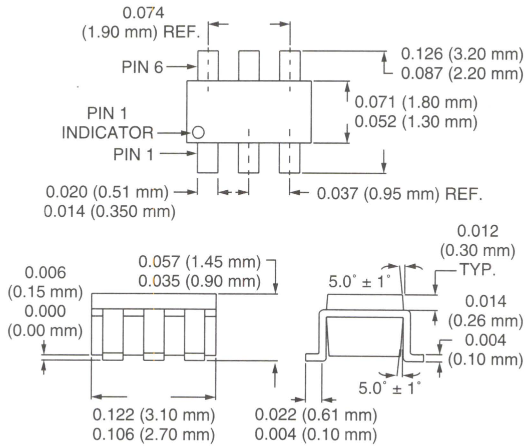
Note: Exceeding these parameters may cause irreversible damage.

Recommended Board Layout



Material is 10 mil FR4.

SOT-6



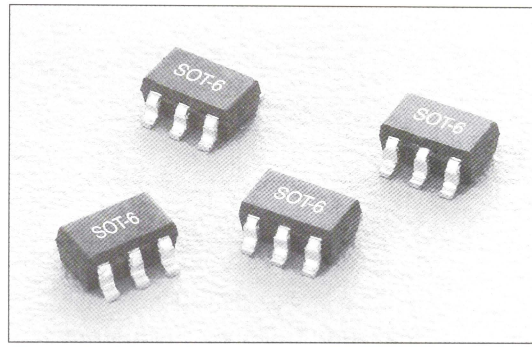
Directional Coupler 0.81–0.96 GHz

SKYWORKS

DC09-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel



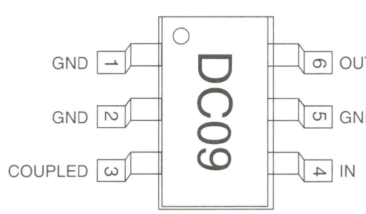
Description

The DC09-73 is a monolithic directional coupler tailored to the 0.81–0.96 GHz band. It offers low loss, good isolation, good input/output matching and exceptional coupling repeatability. It is available in the SOT-6 lead surface mount package.

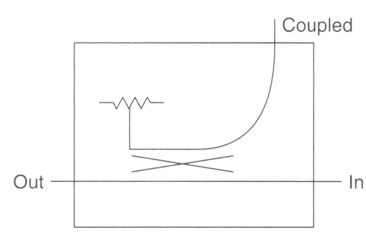
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	0.81		0.96	GHz
Insertion Loss		0.2	0.3	dB
Isolation	27	30		dB
Input VSWR		1.1:1	1.3:1	
Output VSWR		1.1:1	1.3:1	
Coupling	20.8	19.8	18.8	dB
Coupled Port VSWR		1.1:1	1.3:1	

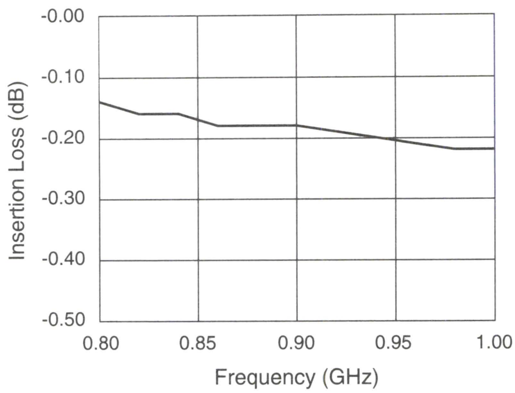
Pin Out



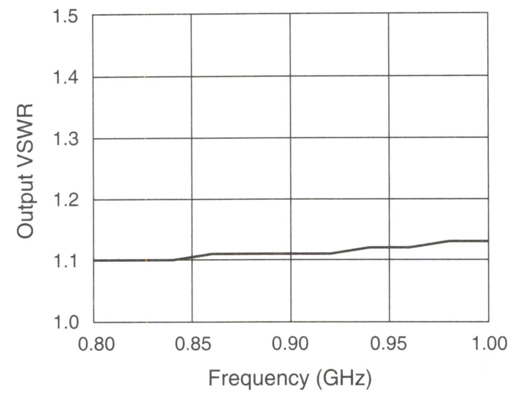
Block Diagram



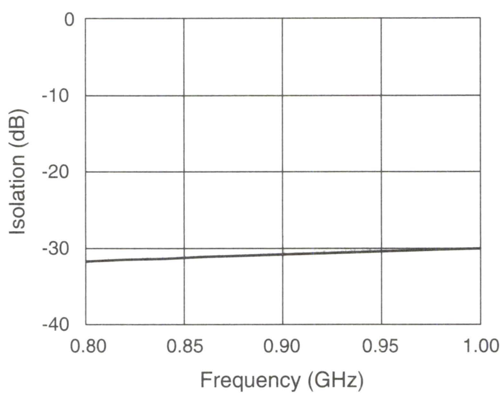
Typical Performance Data



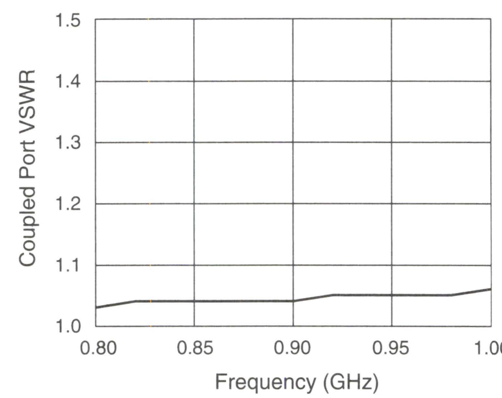
Insertion Loss vs. Frequency



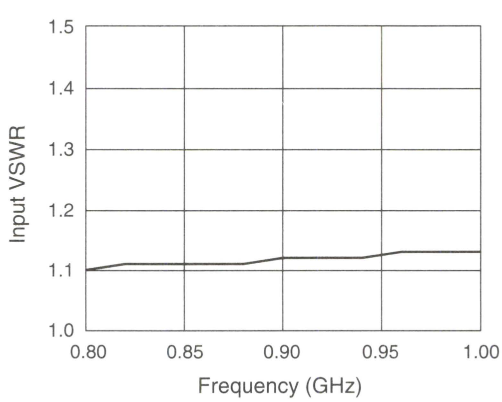
Output VSWR vs. Frequency



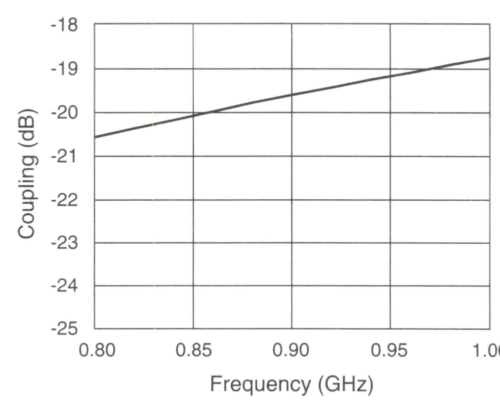
Isolation vs. Frequency



Coupled Port VSWR vs. Frequency



Input VSWR vs. Frequency



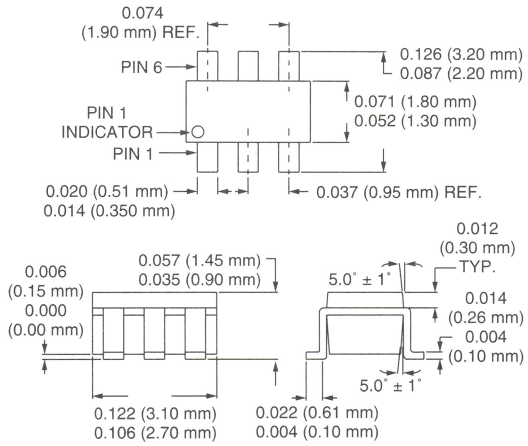
Coupling vs. Frequency

Absolute Maximum Ratings

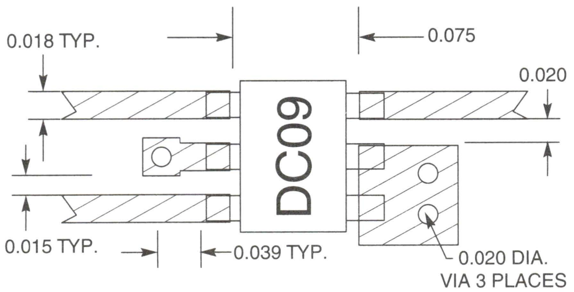
Characteristic	Value
Input Power[1]	4.0 W CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

1. When operating with a 2.0:1 maximum VSWR on all ports.

SOT-6



Recommended Board Layout



Material is 10 mil FR4

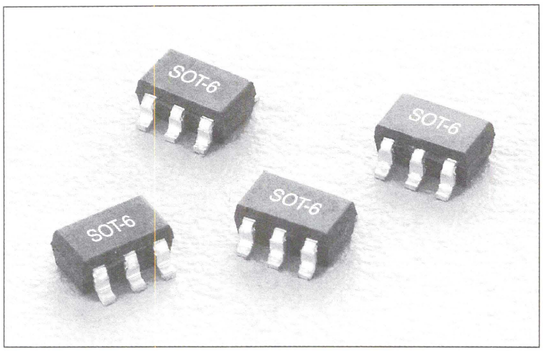
Directional Coupler 1.42–1.66 GHz

SKYWORKS

DC15-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel



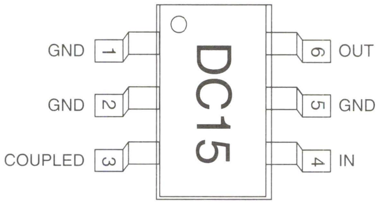
Description

The DC15-73 is a monolithic directional coupler tailored to the 1.42–1.66 GHz band. It offers low loss, good isolation, good input/output matching and exceptional coupling repeatability. It is available in the SOT-6 lead surface mount package.

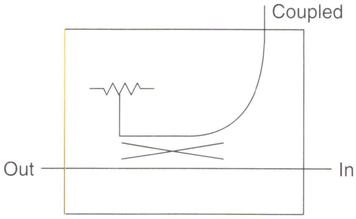
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.42		1.66	GHz
Insertion Loss		0.2	0.3	dB
Isolation	30	34		dB
Input VSWR		1.1:1	1.3:1	
Output VSWR		1.1:1	1.3:1	
Coupling	19.4	18.4	17.4	dB
Coupled Port VSWR		1.1:1	1.3:1	

Pin Out



Block Diagram



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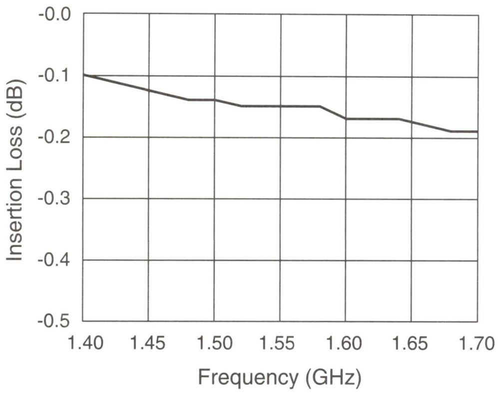
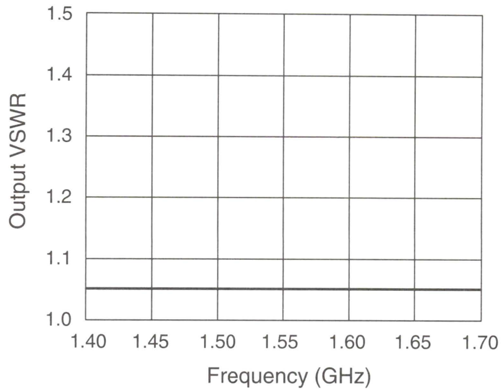
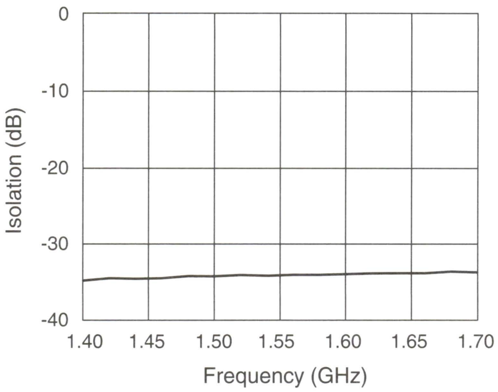
Typical Performance Data



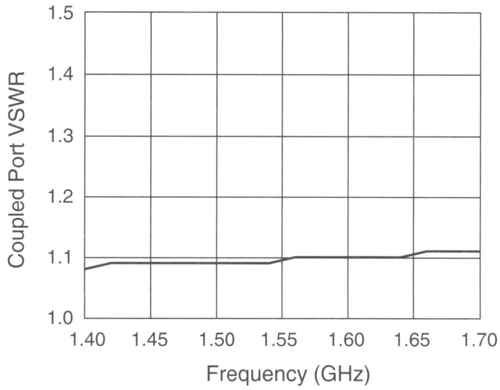
Insertion Loss vs. Frequency



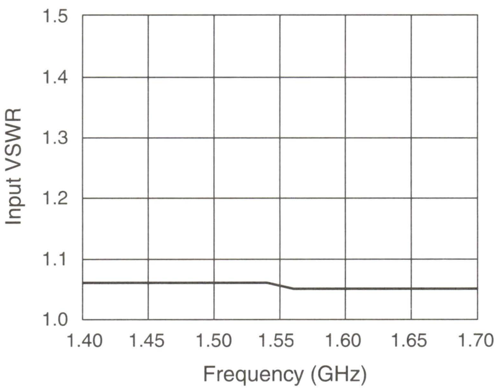
Output VSWR vs. Frequency



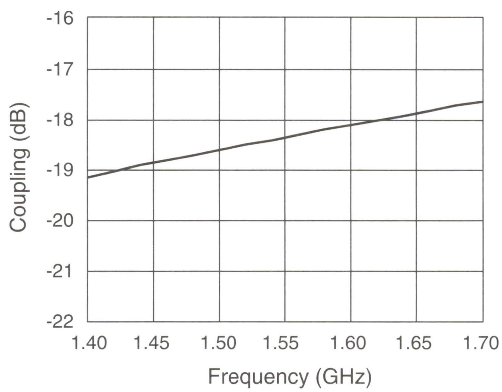
Isolation vs. Frequency



Coupled Port VSWR vs. Frequency



Input VSWR vs. Frequency



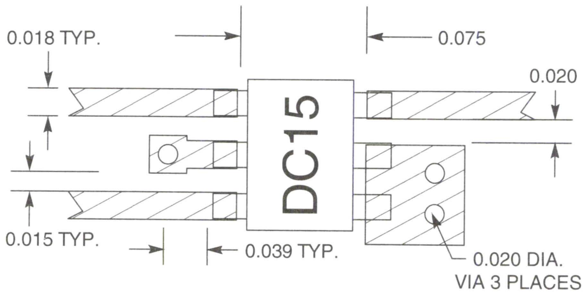
Coupling vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	4.0 W CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

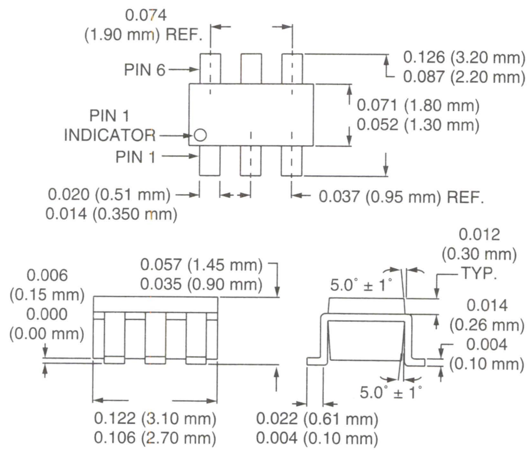
1. When operating with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOT-6



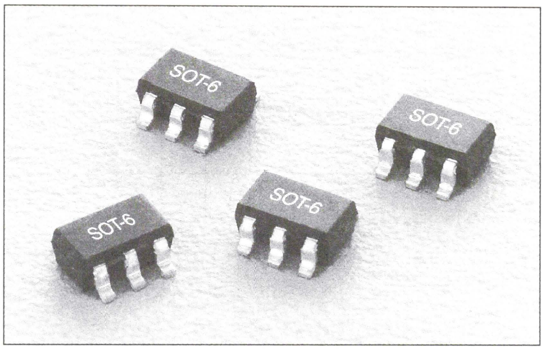
Directional Coupler

SKYWORKS

DC16-73

Features

- Low Cost
- Low Profile
- Small SOT-6 Package
- Tape & Reel



Description

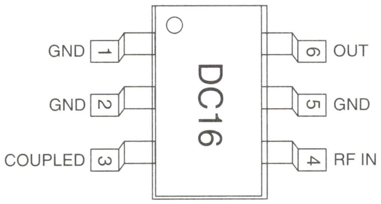
The DC16-73 is a monolithic directional coupler for low cost wireless applications. It offers low loss, good isolation, good input/output matching and exceptional coupling repeatability. Performance is specified for two different bands. It is available in the SOT-6 leaded surface mount package.

Electrical Specifications at 25°C

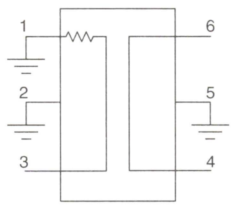
Parameter	Min.	Typ.	Max.	Unit	Min.	Typ.	Max.	Unit
Frequency	1.42		1.66	GHz	1.71		1.99	GHz
Insertion Loss[1]		.25	.35	dB		.35	.45	dB
Isolation	23	24		dB	22	23		dB
Input VSWR		1.1:1	1.3:1			1.1:1	1.3:1	
Output VSWR		1.1:1	1.3:1			1.1:1	1.3:1	
Coupling	14.6	15.6	16.6	dB	13.8	14.8	15.8	dB
Coupled Port VSWR		1.1:1	1.3:1			1.1:1	1.3:1	

1. Coupling loss included.

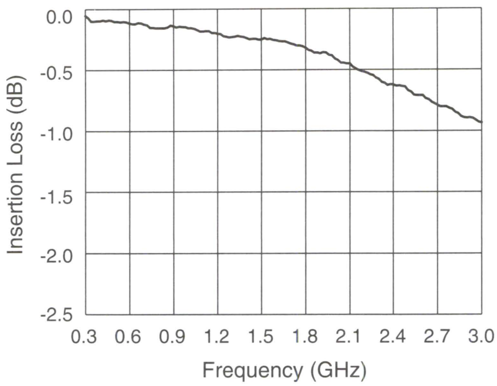
Pin Out



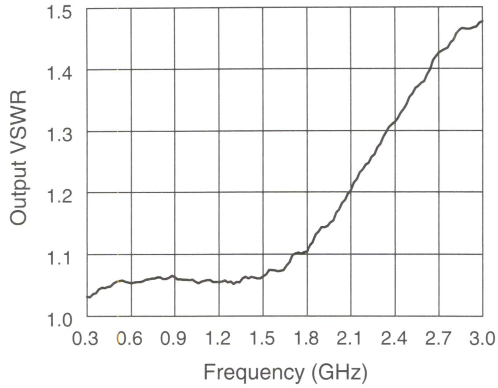
Block Diagram



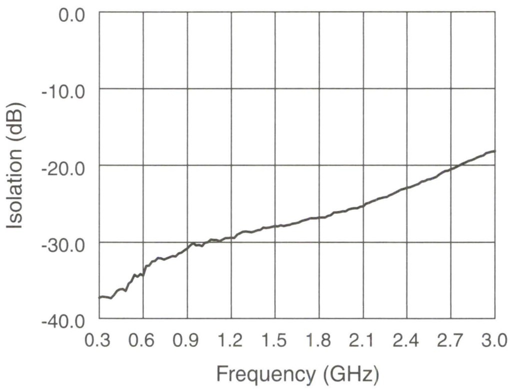
Typical Performance Data



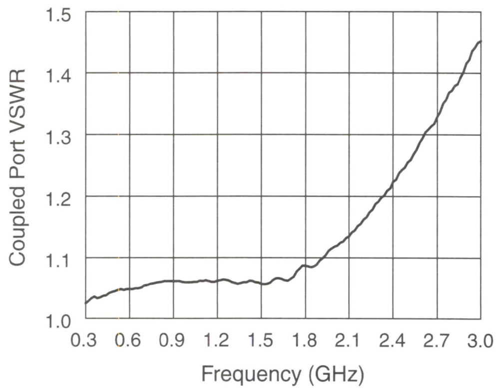
Insertion Loss vs. Frequency



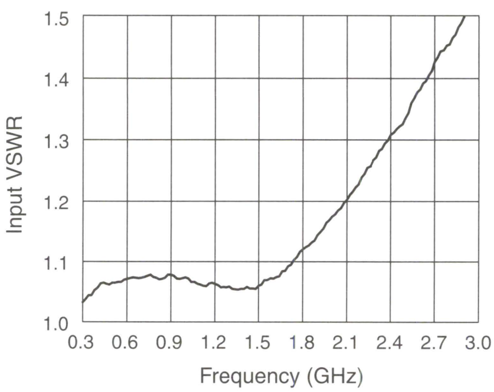
Output VSWR vs. Frequency



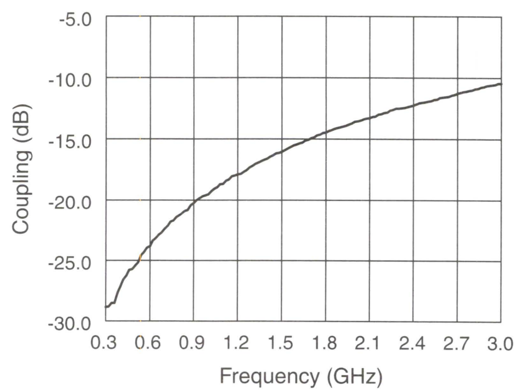
Isolation vs. Frequency



Coupled Port VSWR vs. Frequency



Input VSWR vs. Frequency



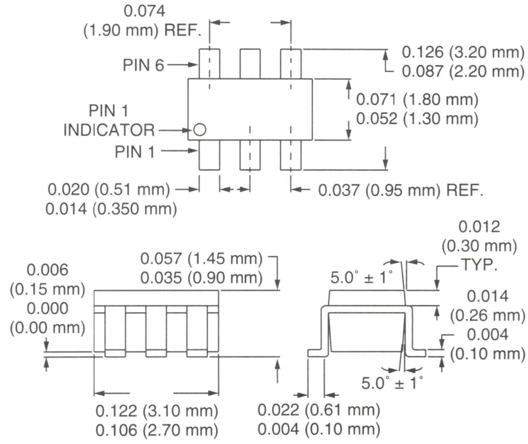
Coupling vs. Frequency

Absolute Maximum Ratings

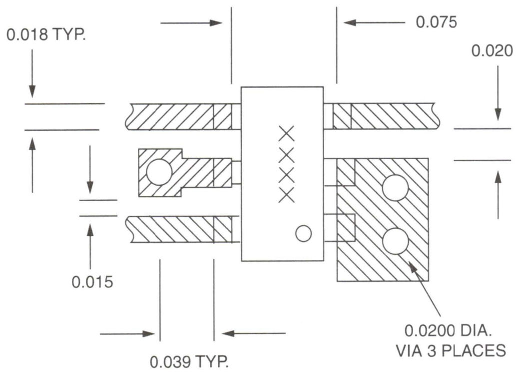
Characteristic	Value
Input Power	+4 W
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Electrostatic Discharge	+125 V

Note: Exceeding these parameters may cause irreversible damage.

SOT-6



Recommended Board Layout



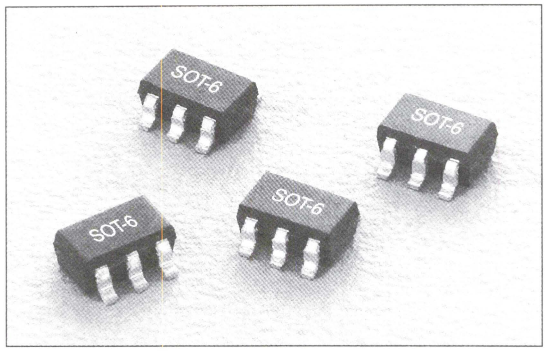
Material is 10 mil FR4.

Directional Coupler

SKYWORKS

DC17-73

Features
- Low Cost
- Low Profile
- Small SOT-6 Package
- Tape & Reel



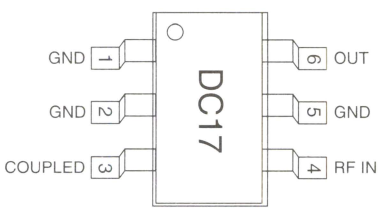
Description
The DC17-73 is a monolithic directional coupler for low cost wireless applications. It offers low loss, good isolation, good input/output matching and exceptional coupling repeatability. Performance specified for two different bands. It is available in the SOT-6 lead surface mount package.

Electrical Specifications at 25°C

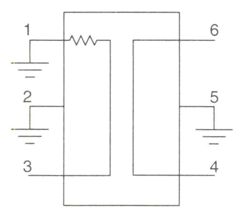
Parameter	Min.	Typ.	Max.	Unit	Min.	Typ.	Max.	Unit
Frequency	1.42		1.66	GHz	1.71		1.99	GHz
Insertion Loss[1]		.60	.70	dB		.75	.85	dB
Isolation	21	22		dB	20	21		dB
Input VSWR		1.1:1	1.3:1			1.1:1	1.3:1	
Output VSWR		1.1:1	1.3:1			1.1:1	1.3:1	
Coupling	10.8	11.8	12.8	dB	9.3	10.3	11.3	dB
Coupled Port VSWR		1.2:1	1.3:1			1.25:1	1.35:1	

1. Coupling loss included.

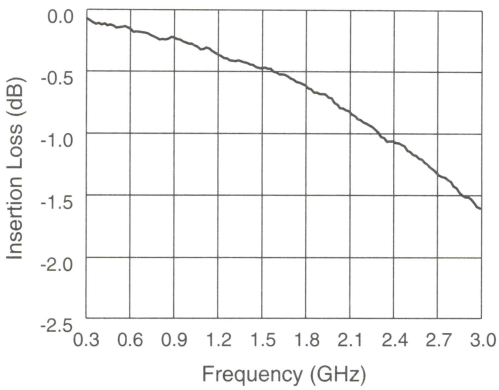
Pin Out



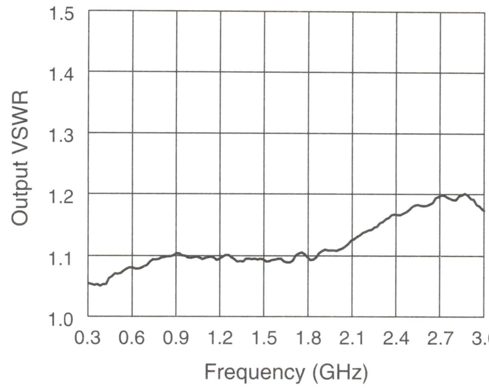
Block Diagram



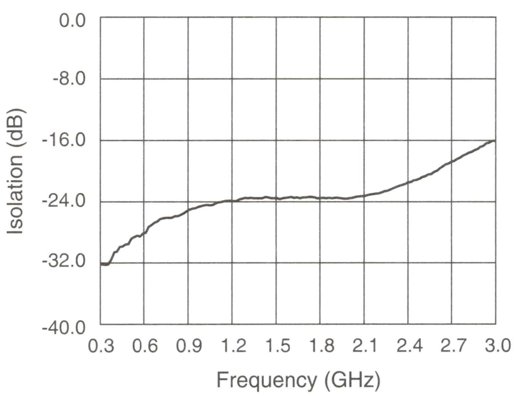
Typical Performance Data



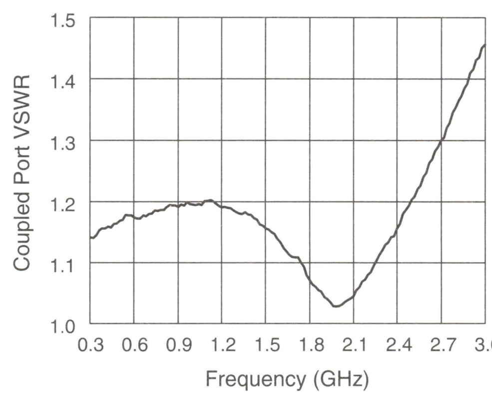
Insertion Loss vs. Frequency



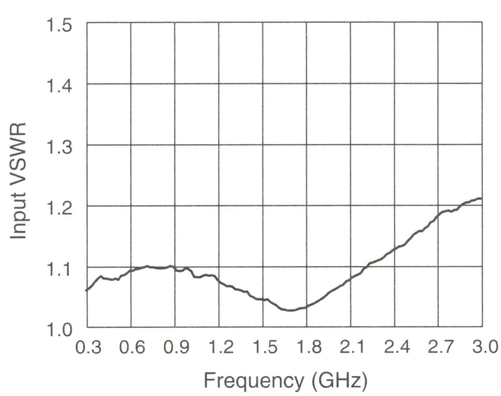
Output VSWR vs. Frequency



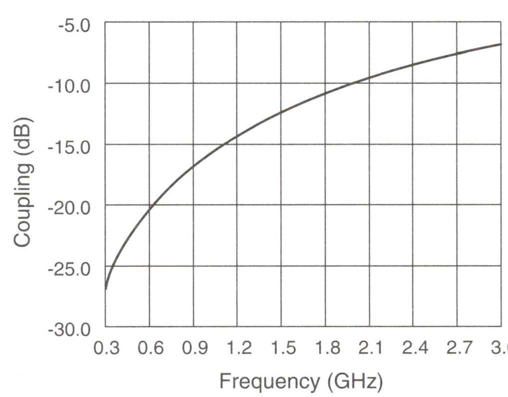
Isolation vs. Frequency



Coupled Port VSWR vs. Frequency



Input VSWR vs. Frequency



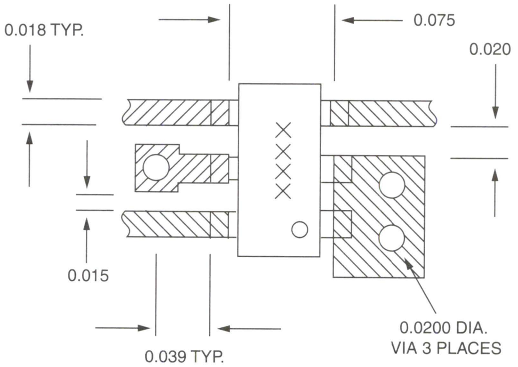
Coupling vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power	+4 W
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Electrostatic Discharge	+125 V

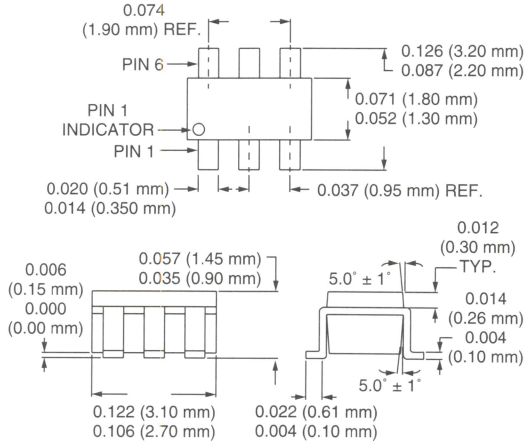
Note: Exceeding these parameters may cause irreversible damage.

Recommended Board Layout



Material is 10 mil FR4.

SOT-6



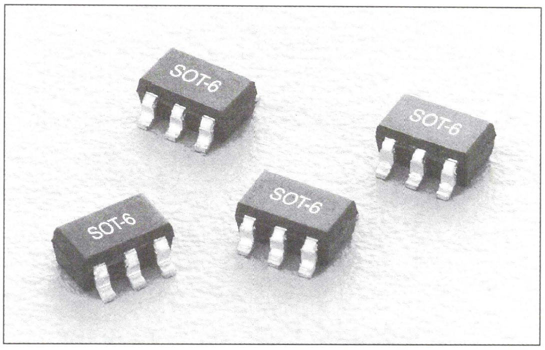
Directional Coupler 1.71–1.99 GHz

SKYWORKS

DC18-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel



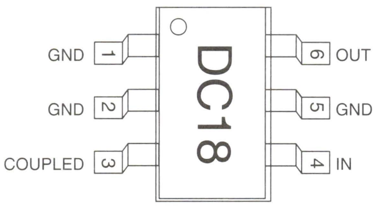
Description

The DC18-73 is a monolithic directional coupler tailored to the 1.71–1.99 GHz band. It offers low loss, good isolation, good input/output matching and exceptional coupling repeatability. It is available in the SOT-6 lead surface mount package.

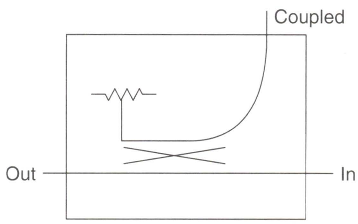
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	1.71		1.99	GHz
Insertion Loss		0.2	0.3	dB
Isolation	30	38		dB
Input VSWR		1.1:1	1.3:1	
Output VSWR		1.1:1	1.3:1	
Coupling	19.8	18.8	17.8	dB
Coupled Port VSWR		1.2:1	1.4:1	

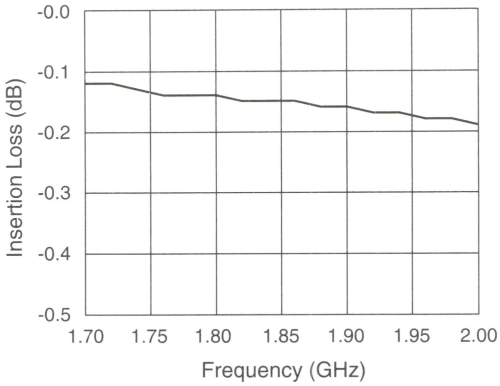
Pin Out



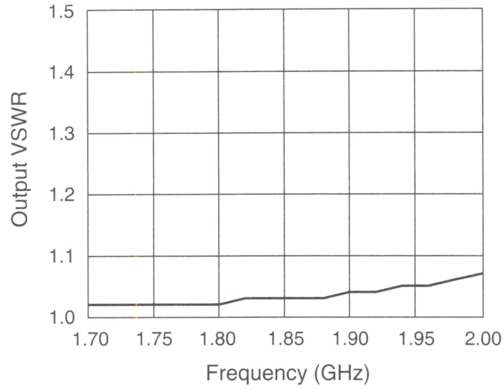
Block Diagram



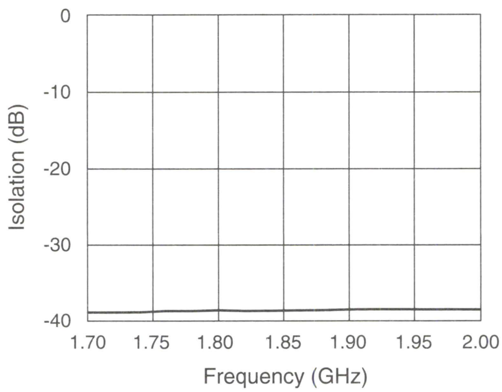
Typical Performance Data



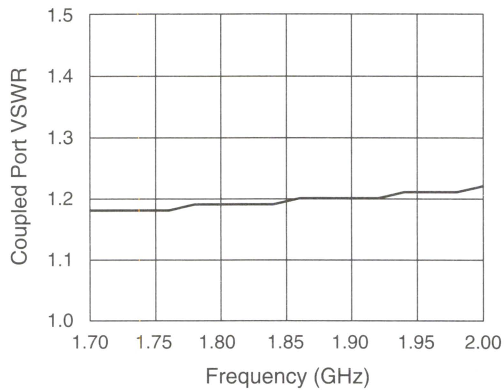
Insertion Loss vs. Frequency



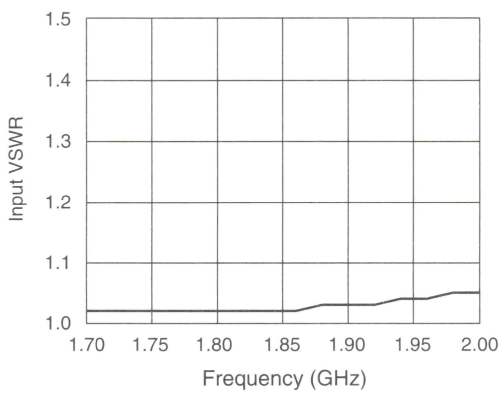
Output VSWR vs. Frequency



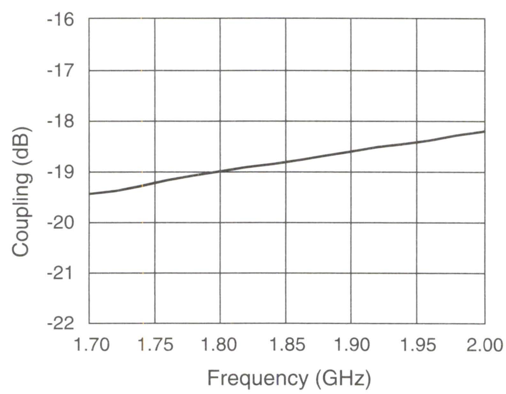
Isolation vs. Frequency



Coupled Port VSWR vs. Frequency



Input VSWR vs. Frequency



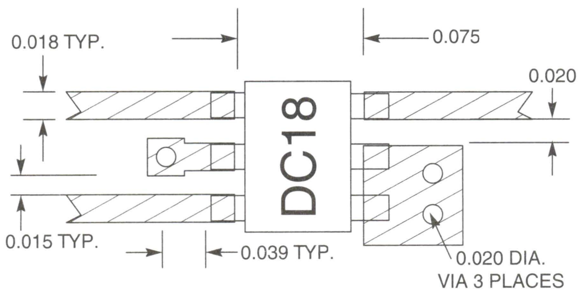
Coupling vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	4.0 W CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

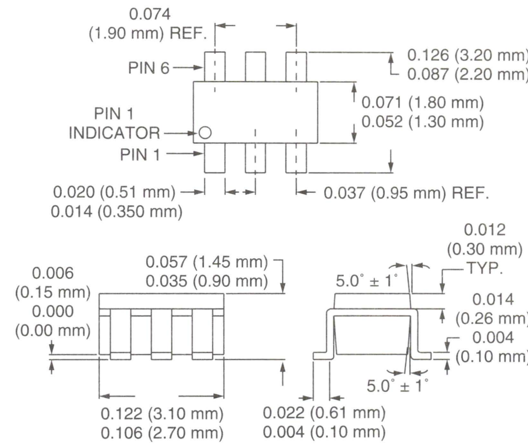
1. When operating with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOT-6



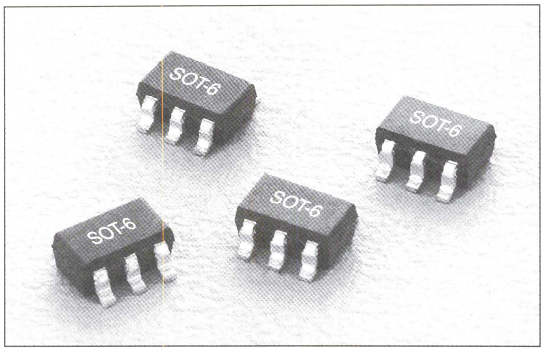
Directional Coupler 2.30–2.60 GHz

SKYWORKS

DC25-73

Features

- Low Cost
- Low Profile
- Available in Small SOT-6 Lead Package
- Tape & Reel



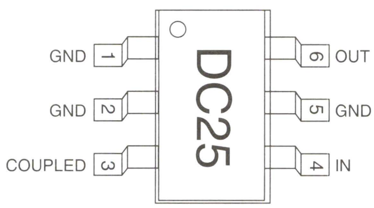
Description

The DC25-73 is a monolithic directional coupler tailored to the 2.30–2.60 GHz band. It offers low loss, good isolation, good input/output matching and exceptional coupling repeatability. It is available in the SOT-6 lead surface mount package.

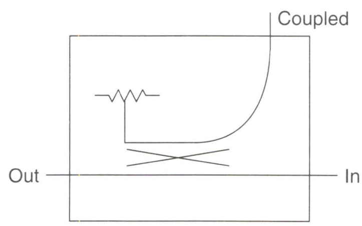
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency	2.30		2.60	GHz
Insertion Loss		0.2	0.3	dB
Isolation	30	33		dB
Input VSWR		1.1:1	1.3:1	
Output VSWR		1.1:1	1.3:1	
Coupling	18.2	17.2	16.2	dB
Coupled Port VSWR		1.3:1	1.5:1	

Pin Out



Block Diagram



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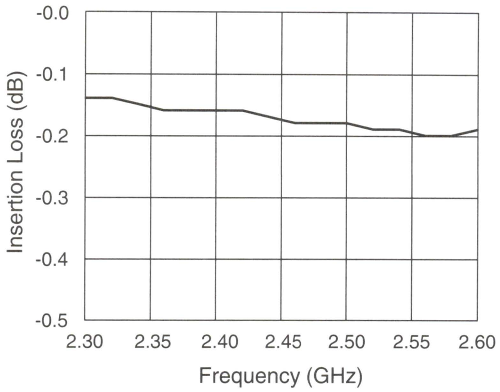
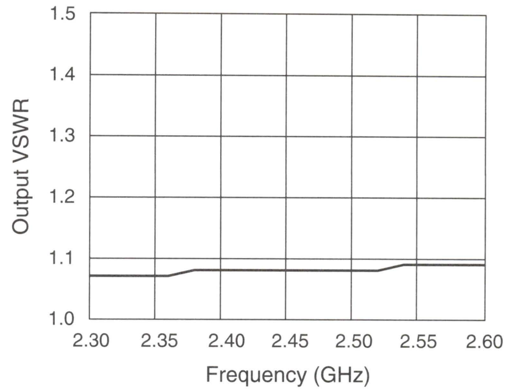
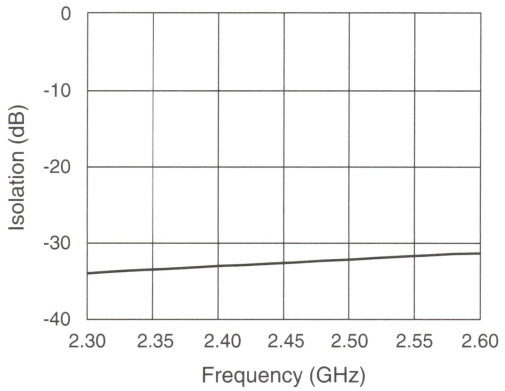
Typical Performance Data



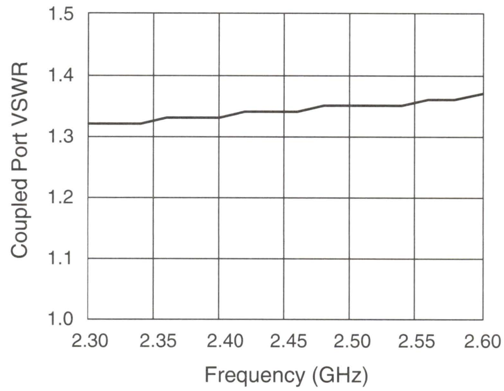
Insertion Loss vs. Frequency



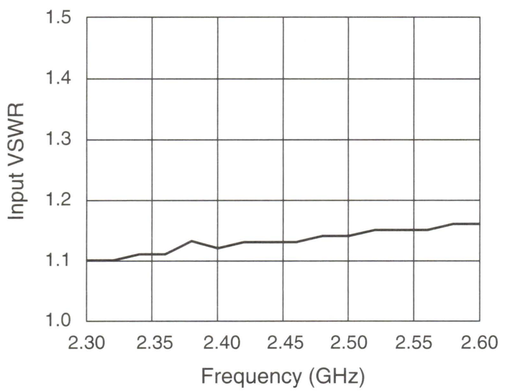
Output VSWR vs. Frequency



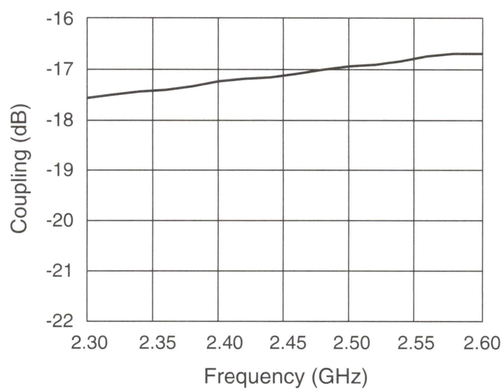
Isolation vs. Frequency



Coupled Port VSWR vs. Frequency



Input VSWR vs. Frequency



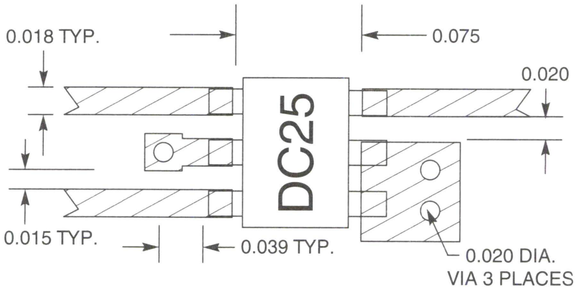
Coupling vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	+4.0 W CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

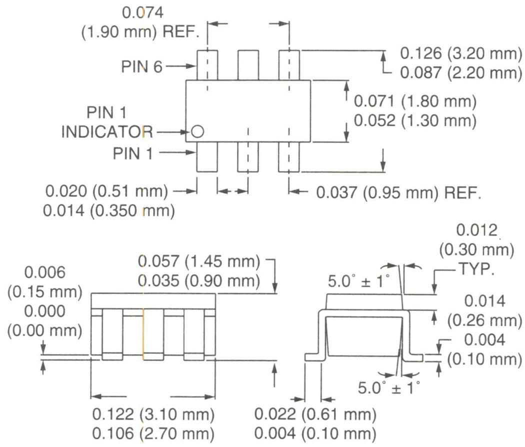
1. When operating with a 2.0:1 maximum VSWR on all ports.

Recommended Board Layout



Material is 10 mil FR4

SOT-6



Hybrids

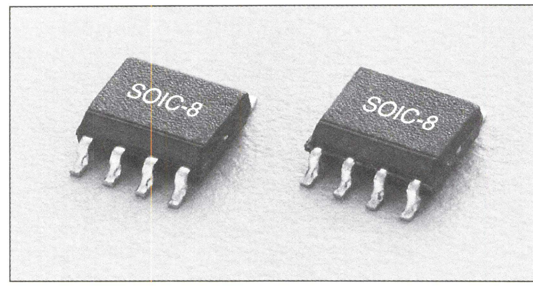
90 Degree Hybrid 0.82–0.90 GHz

SKYWORKS

HY86-12

Features

- Low Cost
- Low Profile
- Small SOIC-8 Package
- Tape & Reel



Description

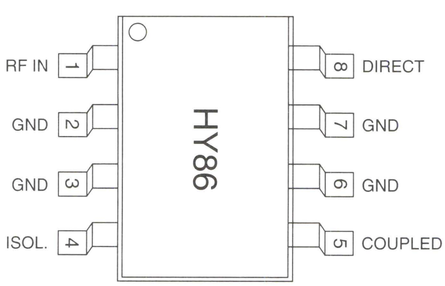
The HY86-12 is a 90 degree hybrid tuned for the 0.82–0.90 GHz band. The monolithic circuitry is 100% passive and offers low loss, high isolation and exceptional phase/amplitude balance. It is available in the SOIC-8 leaded surface mount package.

Electrical Specifications at 25°C

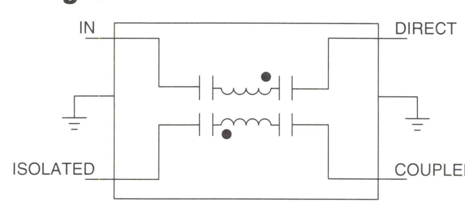
Parameter	Min.	Typ.	Max.	Unit
Frequency	0.82		0.90	GHz
Insertion Loss[1]		.4	.5	dB
Isolation	25	30		dB
VSWR All Ports		1.15:1	1.2:1	
Amplitude Balance		±.5	±.8	dB
Phase Balance		±1.0	±2.0	Deg.

1. Less 3 dB power split.

Pin Out

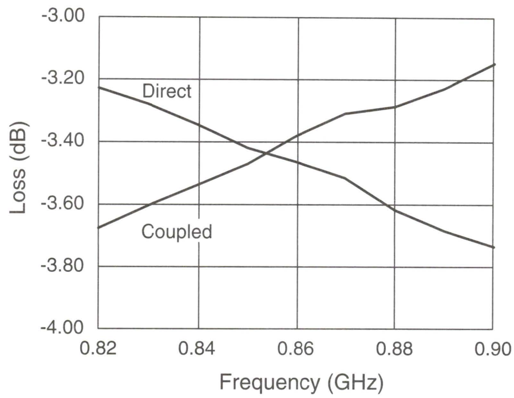


Block Diagram

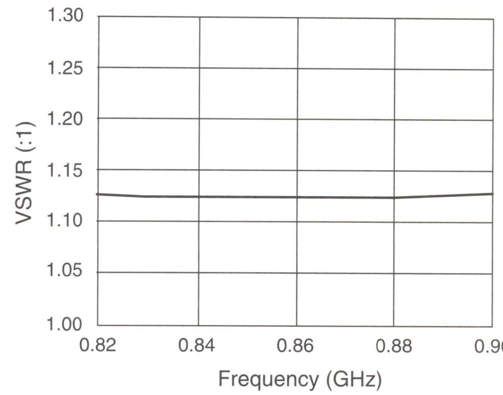


 Skyworks Solutions, Inc. [781] 376-3000 • Fax [781] 376-3100 • Email sales@skyworksinc.com • www.skyworksinc.com

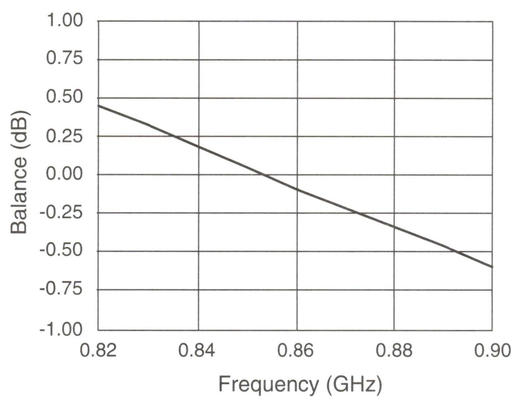
Typical Performance Data



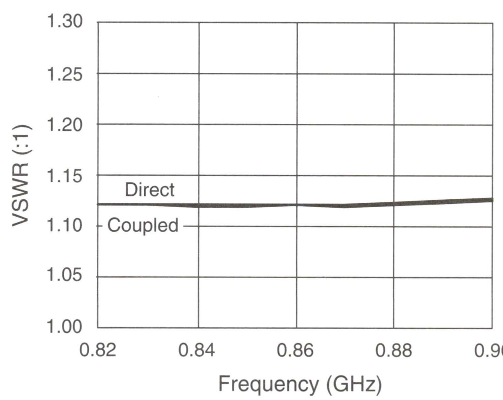
Path Losses vs. Frequency



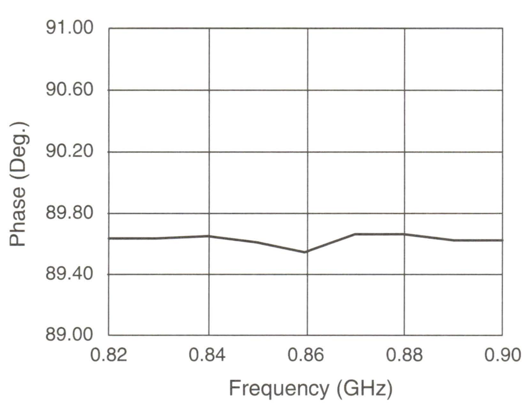
Input VSWR vs. Frequency



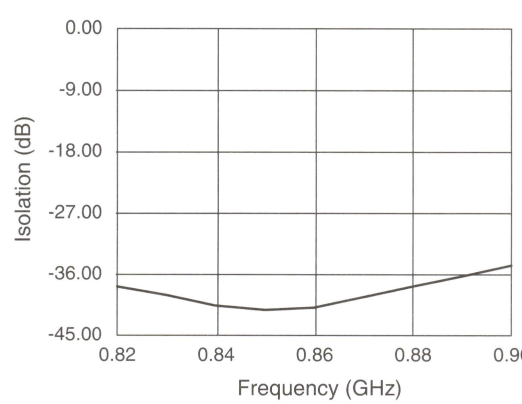
Amplitude Balance vs. Frequency



Output VSWR vs. Frequency



Coupled – Direct Phase vs. Frequency



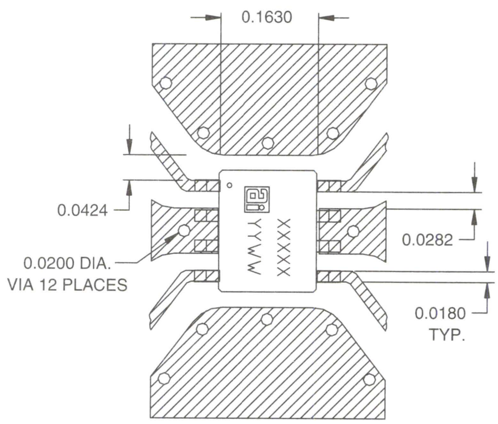
Isolation vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	+4 W
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Electrostatic Discharge	+125 V

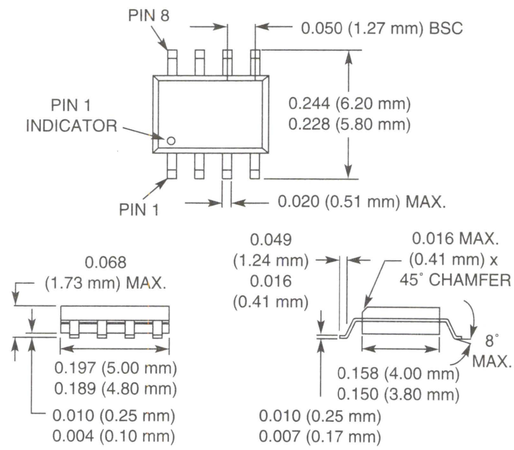
1. Exceeding these parameters may cause irreversible damage.

Recommended Board Layout



Materials 10 mil FR-4.
Dimensions are in inches.

SOIC-8

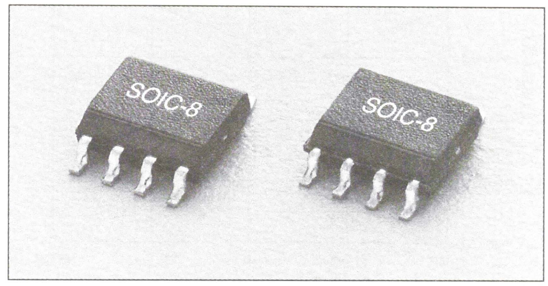


90 Degree Hybrid 0.88–0.96 GHz

SKYWORKS

HY92-12

Features
- Low Cost
- Low Profile
- Small SOIC-8 Package
- Tape & Reel



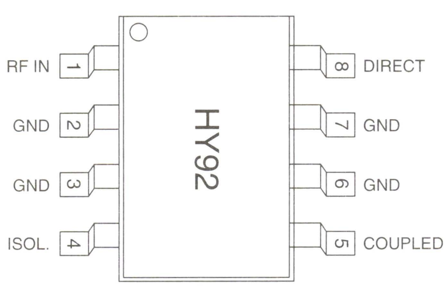
Description
The HY92-12 is a 90 degree hybrid tuned for the 0.88–0.96 GHz band. The monolithic circuitry is 100% passive and offers low loss, high isolation and exceptional phase/amplitude balance. It is available in the SOIC-8 leaded surface mount package.

Electrical Specifications at 25°C

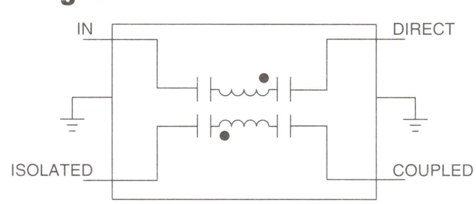
Parameter	Min.	Typ.	Max.	Unit
Frequency	0.88		0.96	GHz
Insertion Loss[1]		.4	.5	dB
Isolation	20	25		dB
VSWR All Ports		1.1:1	1.2:1	
Amplitude Balance		±.5	±.8	dB
Phase Balance		±1.0	±2.0	Deg.

1. Less 3 dB power split.

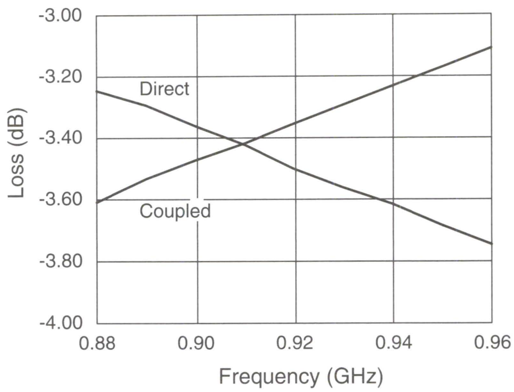
Pin Out



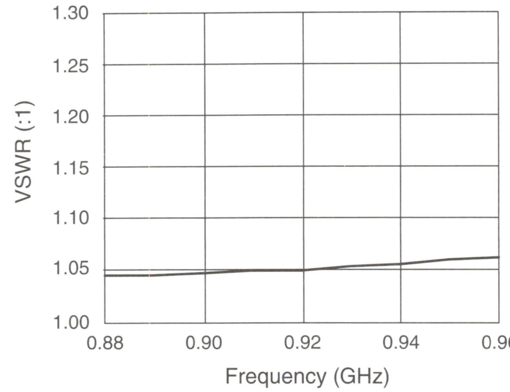
Block Diagram



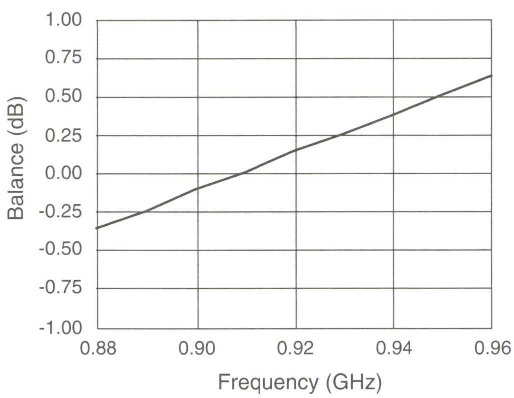
Typical Performance Data



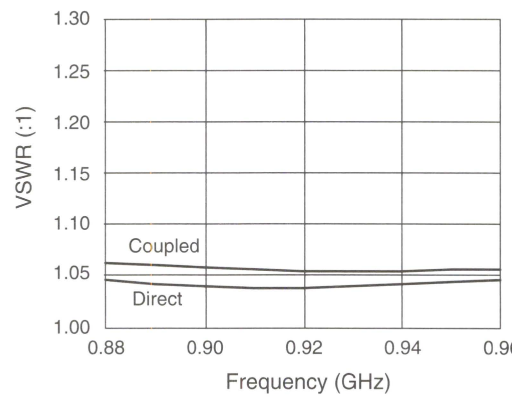
Path Losses vs. Frequency



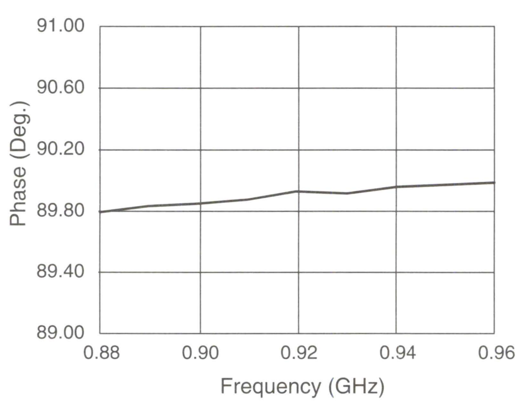
Input VSWR vs. Frequency



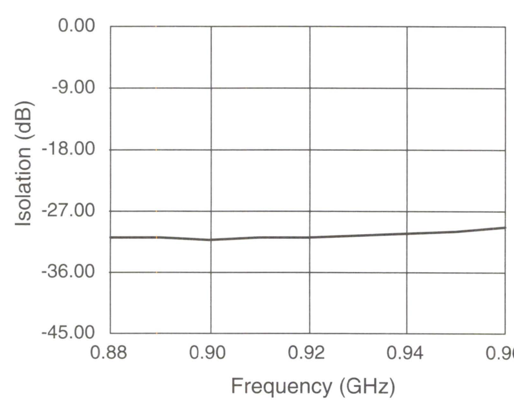
Amplitude Balance vs. Frequency



Output VSWR vs. Frequency



Coupled – Direct Phase vs. Frequency



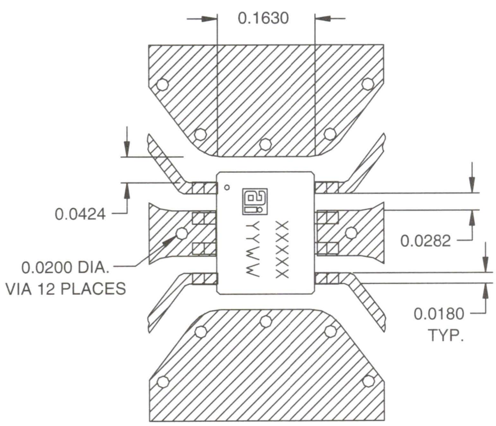
Isolation vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	+4 W
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Electrostatic Discharge	+125 V

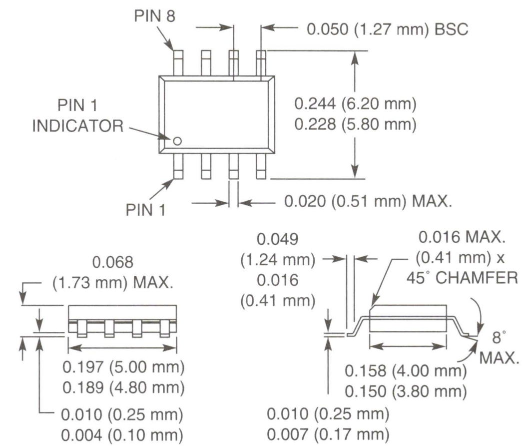
1. Exceeding these parameters may cause irreversible damage.

Recommended Board Layout



Materials 10 mil FR-4.
Dimensions are in inches.

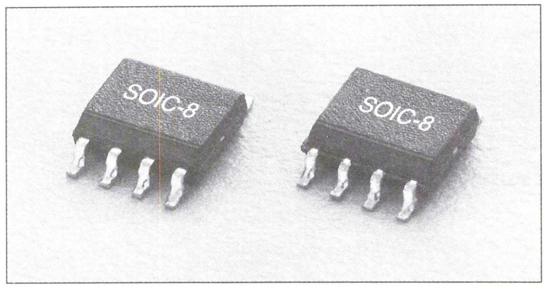
SOIC-8



90 Degree Hybrid 1.71–1.88 GHz

SKYWORKS

HY17-12



Features

- Low Cost
- Low Profile
- Small SOIC-8 Package
- Tape & Reel

Description

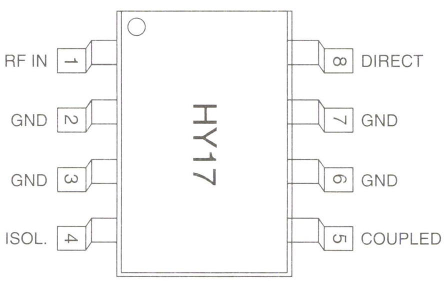
The HY17-12 is a 90 degree hybrid tuned for the 1.71–1.88 GHz band. The monolithic circuitry is 100% passive and offers low loss, high isolation and exceptional phase/amplitude balance. It is available in the SOIC-8 leaded surface mount package.

Electrical Specifications at 25°C

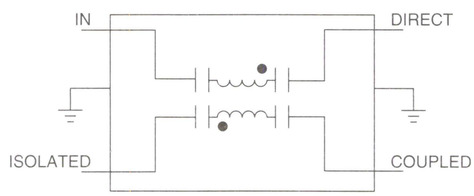
Parameter	Min.	Typ.	Max.	Unit
Frequency	1.71		1.88	GHz
Insertion Loss[1]		.5	.6	dB
Isolation	19	20		dB
VSWR All Ports		1.2:1	1.3:1	
Amplitude Balance		±.5	±1.0	dB
Phase Balance		±1.0	±2.0	Deg.

1. Less 3 dB power split.

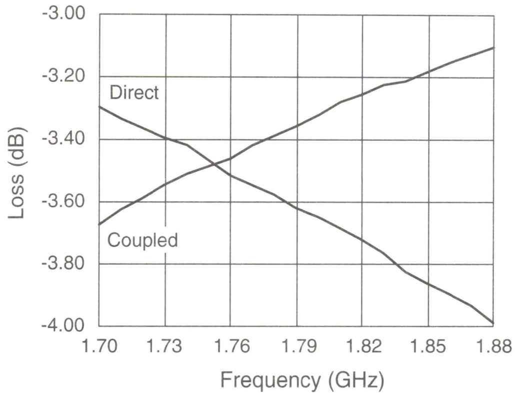
Pin Out



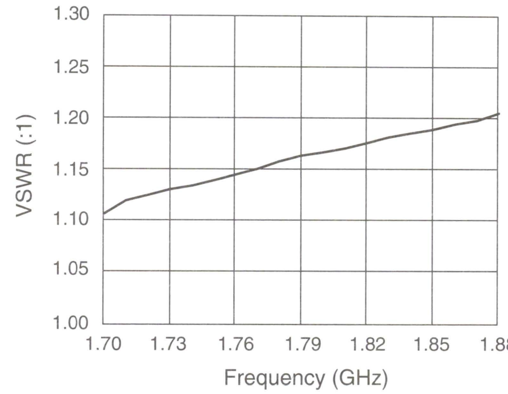
Block Diagram



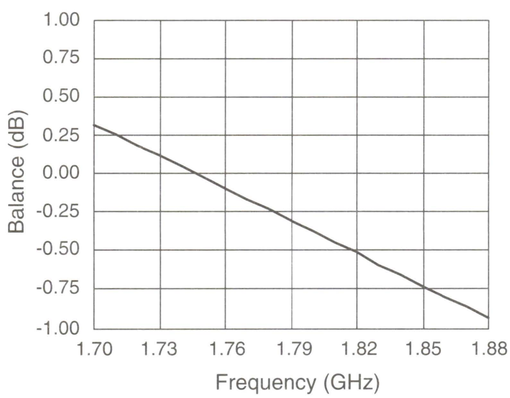
Typical Performance Data



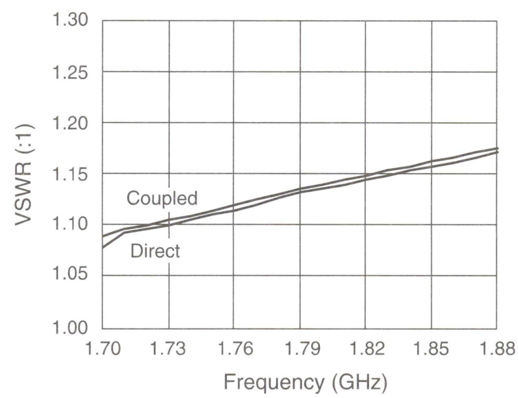
Path Losses vs. Frequency



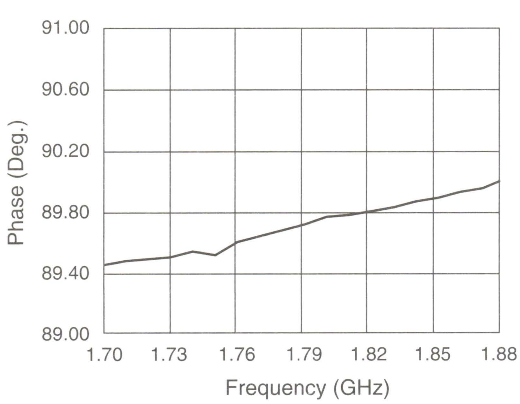
Input VSWR vs. Frequency



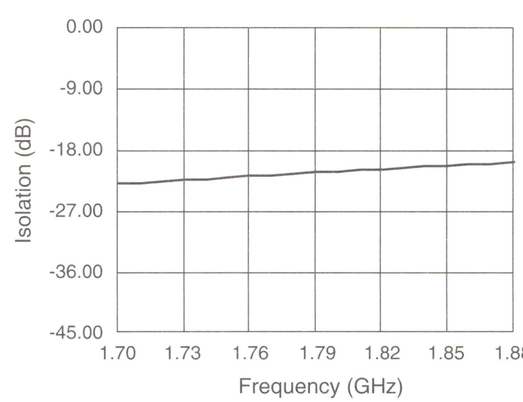
Amplitude Balance vs. Frequency



Output VSWR vs. Frequency



Coupled – Direct Phase vs. Frequency



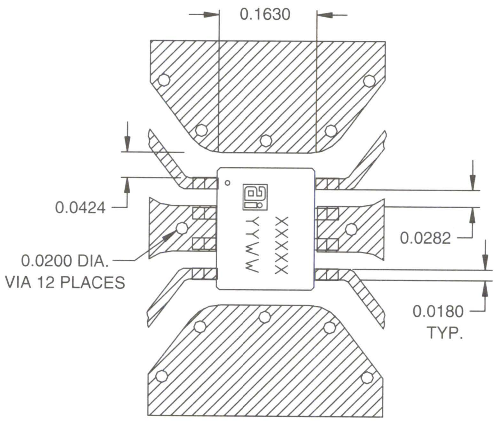
Isolation vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	+4 W
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Electrostatic Discharge	+125 V

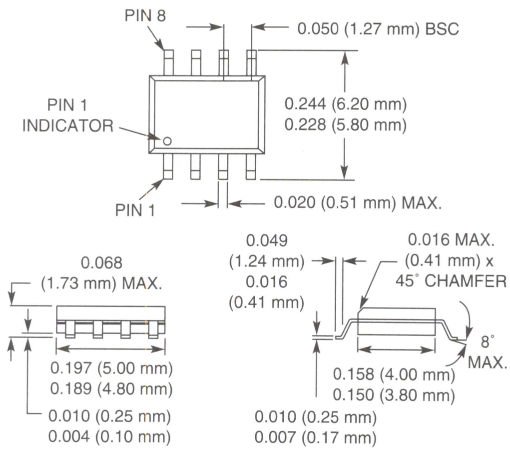
1. Exceeding these parameters may cause irreversible damage.

Recommended Board Layout



Materials 10 mil FR-4.
Dimensions are in inches.

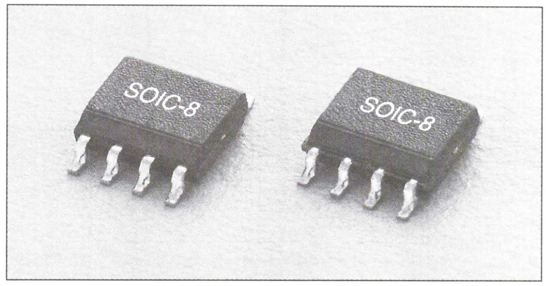
SOIC-8



90 Degree Hybrid 1.85–1.99 GHz

SKYWORKS

HY19-12



Features

- Low Cost
- Low Profile
- Small SOIC-8 Package
- Tape & Reel

Description

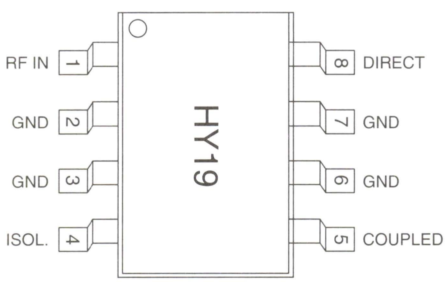
The HY19-12 is a 90 degree hybrid tuned for the 1.85–1.99 GHz band. The monolithic circuitry is 100% passive and offers low loss, high isolation and exceptional phase/amplitude balance. It is available in the SOIC-8 leaded surface mount package.

Electrical Specifications at 25°C

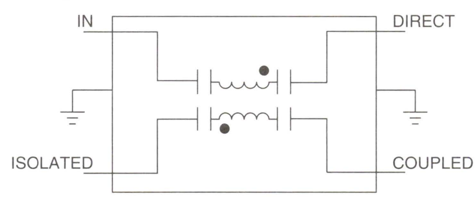
Parameter	Min.	Typ.	Max.	Unit
Frequency	1.85		1.99	GHz
Insertion Loss[1]		.5	.6	dB
Isolation	17	20		dB
VSWR All Ports		1.3:1	1.5:1	
Amplitude Balance		±.5	±1.1	dB
Phase Balance		±1.0	±2.0	Deg.

1. Less 3 dB power split.

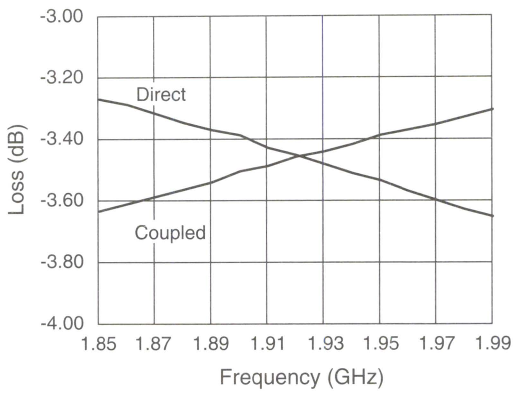
Pin Out



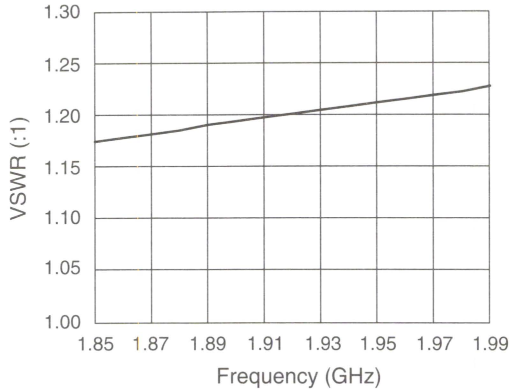
Block Diagram



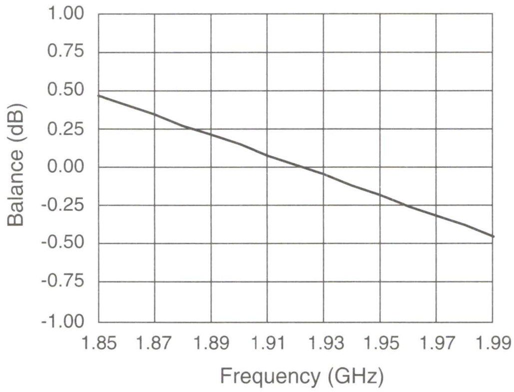
Typical Performance Data



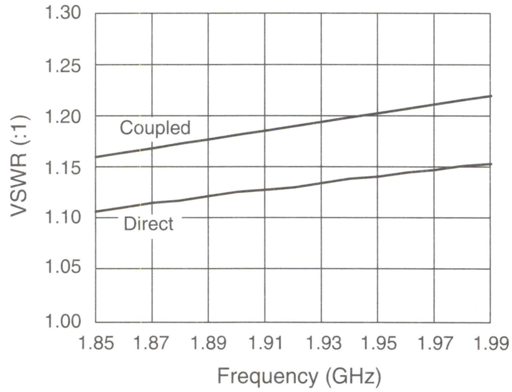
Path Losses vs. Frequency



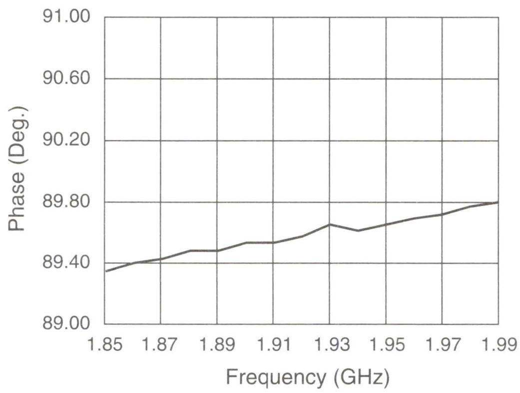
Input VSWR vs. Frequency



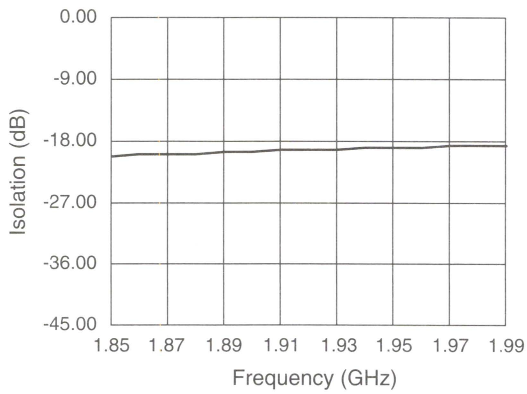
Amplitude Balance vs. Frequency



Output VSWR vs. Frequency



Coupled – Direct Phase vs. Frequency



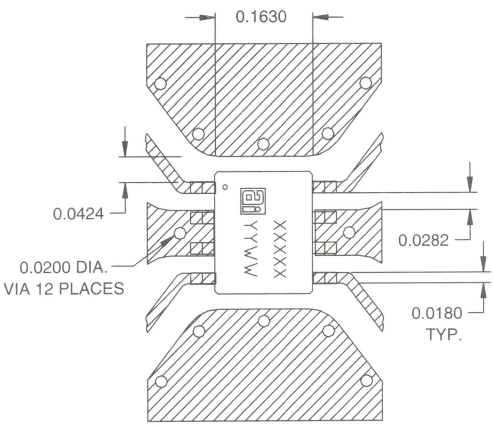
Isolation vs. Frequency

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	+4 W
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Electrostatic Discharge	+125 V

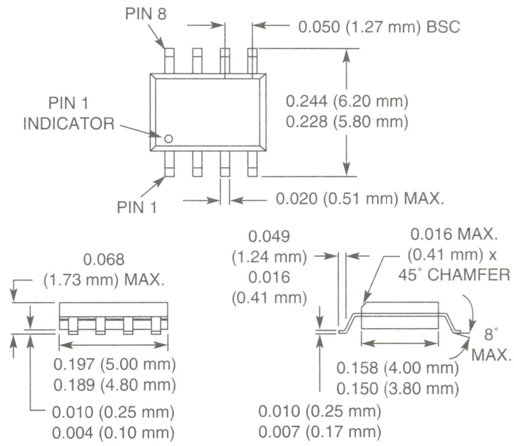
1. Exceeding these parameters may cause irreversible damage.

Recommended Board Layout



Materials 10 mil FR-4.
Dimensions are in inches.

SOIC-8

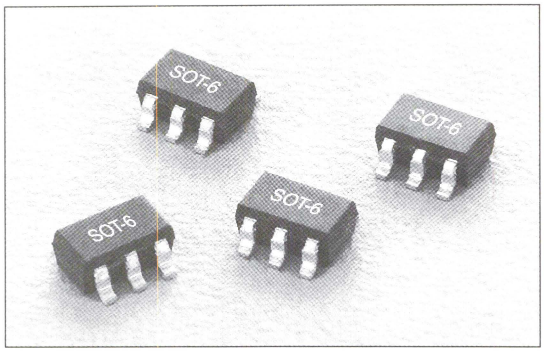


90 Degree Hybrid 2.1–2.3 GHz

HY22-73

Features

- Low Cost
- Low Profile
- Small SOT-6 Package
- Tape & Reel



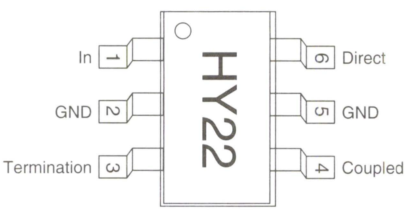
Description

The HY22-73 is a 50 Ω, 90 degree hybrid tuned for the 2.1–2.3 GHz band. The monolithic circuitry is 100% passive and offers low loss, high isolation and exceptional phase/amplitude balance. It is available in the SOT-6 leaded surface mount package.

Electrical Specifications at 25°C, 50 Ω System

Parameter	Min.	Typ.	Max.	Unit
Frequency	2.1		2.3	GHz
Insertion Loss Less 3 dB Split		0.55	0.7	dB
Isolation	20.0	23.00		dB
Input VSWR		1.2:1	1.5:1	
Output VSWR		1.2:1	1.5:1	
Amplitude Balance		±0.40	±1.1	dB
Phase Balance		±2.00	±4.0	Deg.

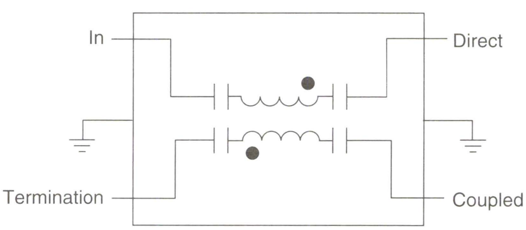
Pin Out



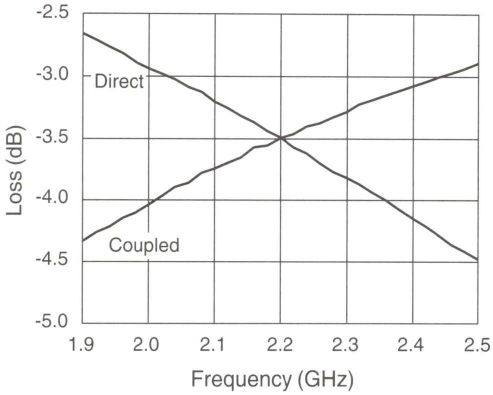
The Pin Out diagram shows the HY22-73 configured for a Divider/Coupler with Pin 1 as the input port and a 50 Ω termination to be placed at Pin 3. Since the HY22-73 is symmetric, any non-ground pin may be used as the input port. The following table shows the possible pin connection combinations for the HY22-73 used as a Divider/Coupler:

Input	Termination	Direct	Coupled
Pin 1	Pin 3	Pin 6	Pin 4
Pin 3	Pin 1	Pin 4	Pin 6
Pin 4	Pin 6	Pin 3	Pin 1
Pin 6	Pin 4	Pin 1	Pin 3

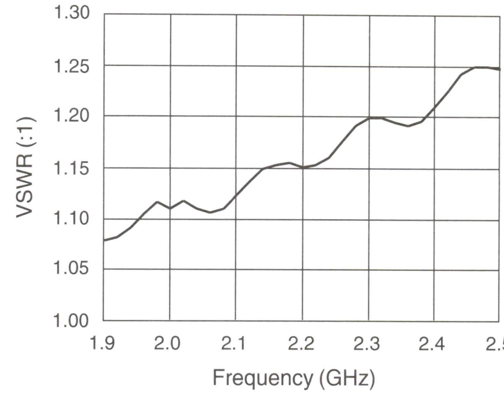
Block Diagram



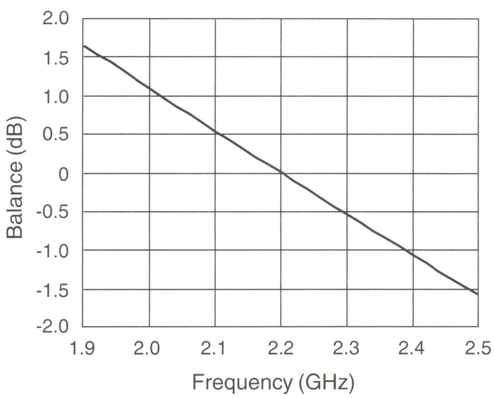
Typical Performance Data



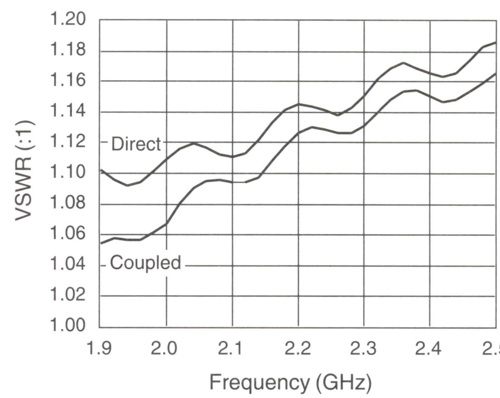
Path Losses vs. Frequency



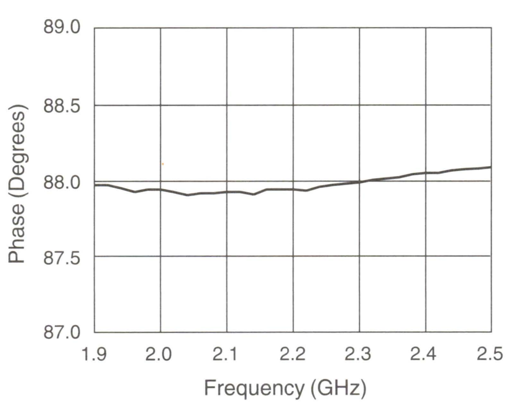
Input VSWR vs. Frequency



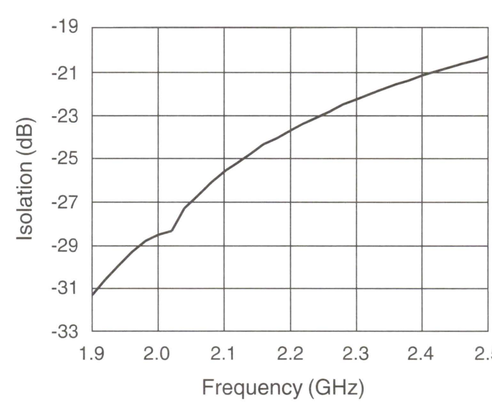
Amplitude Balance vs. Frequency



Output VSWR vs. Frequency

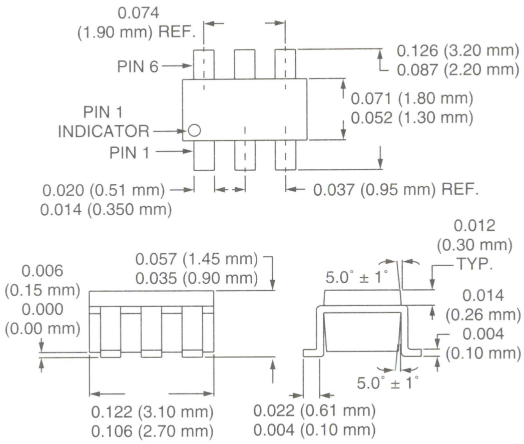


Coupled-Direct Phase vs. Frequency

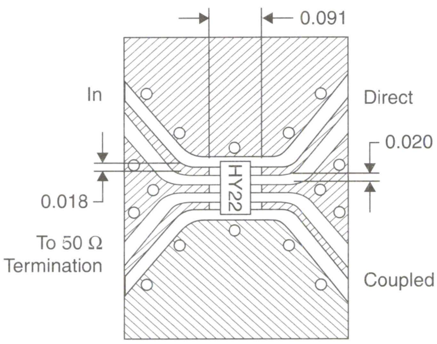


Isolation vs. Frequency

SOT-6



Recommended Board Layout



Material is FR-4. Dimensions are in inches.

Absolute Maximum Ratings

Characteristic	Value
Input Power[1]	2 W CW
Input Power[2]	1 W CW
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

1. When used as a power divider with a 2.0:1 maximum VSWR on all ports.
2. When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

Detectors

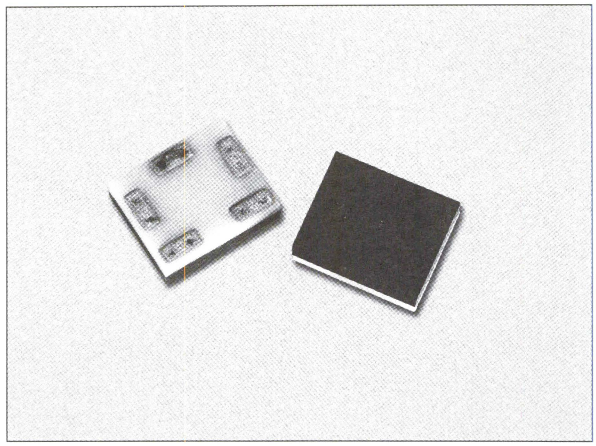
SKYWORKS

Sampling Phase Detectors

SPD1101-111, SPD1102-111, SPD1103-111

Features

- For Phase Locked VCOs to 22 GHz
- Reference Frequencies Below 50 MHz
- New Surface Mount Package Design
- Small Footprint (90 x 110 Mils)
- Automated Chip on Board Construction



Description

Skyworks has redesigned its product line of sampling phase detectors using automated chip on board manufacturing technology to provide a more uniform, surface mountable, small footprint device without sacrificing the microwave performance of the original design.

Sampling phase detectors are used to phase lock a microwave VCO to a stable reference source at a submultiple frequency. The sampling phase detector consists of a step recovery diode, capacitors and a microwave mixer consisting of series pair Schottky diodes. The principle of operation may be described as using the step recovery diode to generate a harmonic comb of the reference oscillator frequency and the Schottky diode as a mixer between the closest reference frequency multiple and the microwave signal generated by the VCO. When these frequencies are identical the IF (beat note) signal is a DC voltage; the IF will be sinusoidal when the frequencies are unequal.

The SPD1100 series sampling phase detectors use a selected step recovery diode chip whose carrier lifetime and transition time are appropriate for use in applications allowing reference frequencies below 50 MHz and microwave VCO frequencies as high as 22 GHz. The Schottky diodes used are low capacitance devices capable of efficient mixer performance at frequencies above 22 GHz. The SPD1101-111, SPD1102-111 and SPD1103-111 utilize low, medium and high barrier Schottky diodes and may be selected according to the available power generated by the microwave VCO.

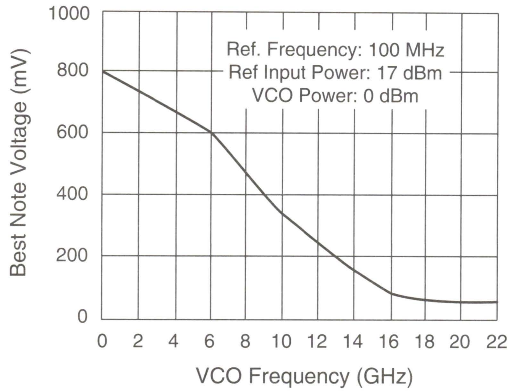
Absolute Maximum Ratings

Characteristic	Value
Incident Power	27 dBm
Operating Temperature	-65 to +150°C
Storage Temperature	-65 to +175°C
ESD Human Body Model	Class 1B

Electrical Characteristics at 25°C

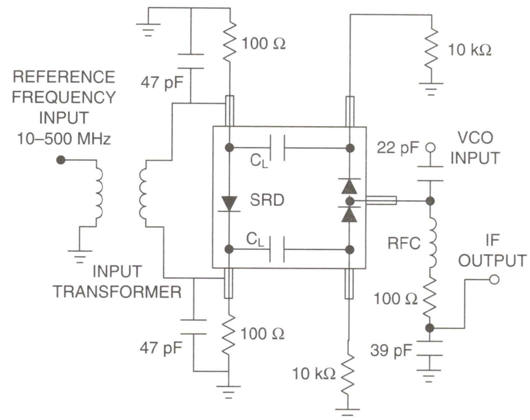
Part Number	Microwave Signal Drive Level (dBm)	Schottky Diode				Capacitor	Step Recovery Diode		
		Barrier	V_F @ 1 mA (mV)	C_J @ 0 V (pF)	R_T @ 5 mA (Ω)	C_C (pF)	C_J @ 6 V (pF)	T_L (nS)	TT (pS)
	Typ.			Max.	Max.	Typ.	Max.	Typ.	Typ.
SPD1101-111	-3 to 0	Low	270–350	0.10	24	0.5	0.25	10	70
SPD1102-111	0 to +3	Medium	370–550	0.10	24	0.5	0.25	10	70
SPD1103-111	0 to +13	High	600–700	0.10	24	0.5	0.25	10	70

Typical Performance



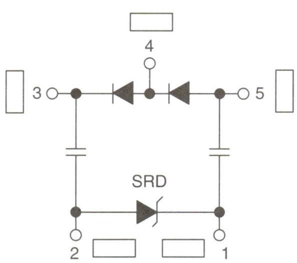
SPD1101-111

Suggested Circuit

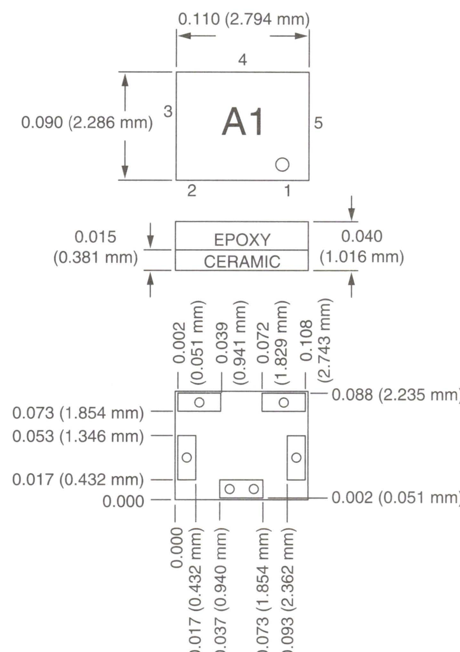


Input transformer: 10:1 step down impedance ratio.

Schematic Diagram



-111 Package Outline



Attenuators

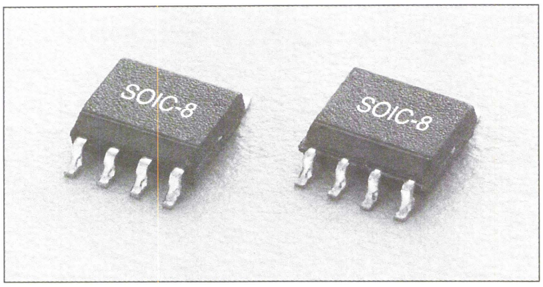
HIP3™ Variable Attenuator 0.80–1.00 GHz

SKYWORKS

AV101-12

Features

- +50 dBm IP3 Typical
- Low Loss 1 dB Typical
- Attenuation 30 dB Typical
- Good VSWR <1.5:1 Typical
- Small SOIC-8 Package



Description

The AV101-12 is a current controlled variable attenuator from Skyworks' series of HIP3™ components. It is designed to meet the wide dynamic range required in spread spectrum wireless base station applications. A monolithic quadrature hybrid is teamed with a silicon PIN diode pair in a plastic surface mount package reducing size and assuring consistency from part to part.

Electrical Specifications at 25°C

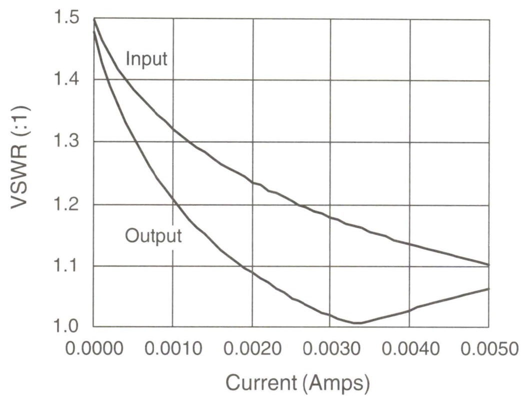
Parameter	Min.	Typ.	Max.	Unit
Frequency	0.80		1.00	GHz
Insertion Loss (0 mA Control Current)		1	1.5	dB
Attenuation @ 3.0 mA Control Current (900 MHz)	18.5		21.5	dB
VSWR All Ports		1.5	1.8	
Input 3rd Order Intercept	+47	+50		dBm
Group Delay		0.9	1.2	ns

Operating Characteristics at 25°C (0, +5 V)

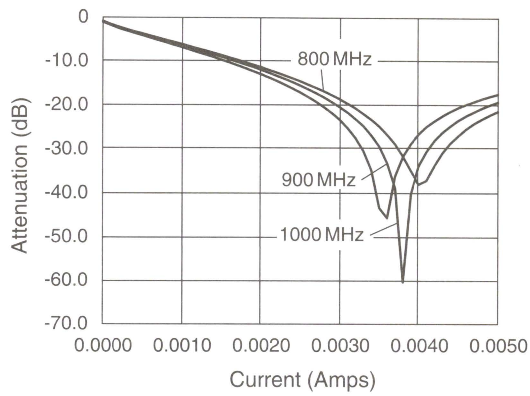
Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[2]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru (Peak)				5 8 5	µs µs mV
Maximum Input Power for <1 dB Attenuation Variation				+15		dBm

1. All measurements made in a 50 Ω system, unless otherwise specified.
2. 0–4 mA square wave total control current.

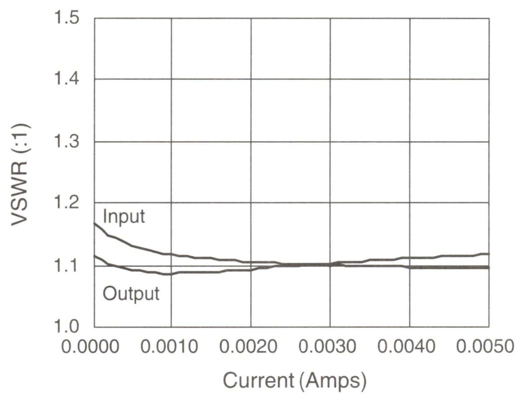
Typical Performance Data



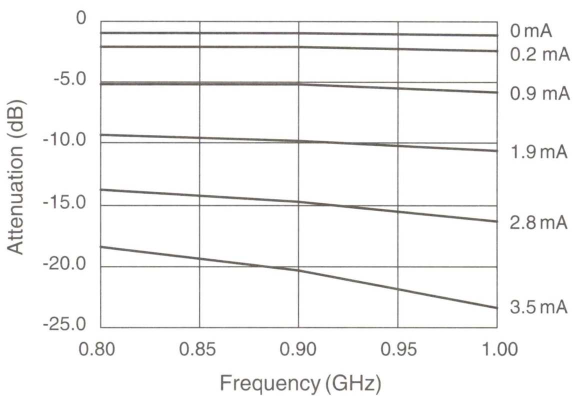
Input/Output VSWR vs. Current @ 800 MHz



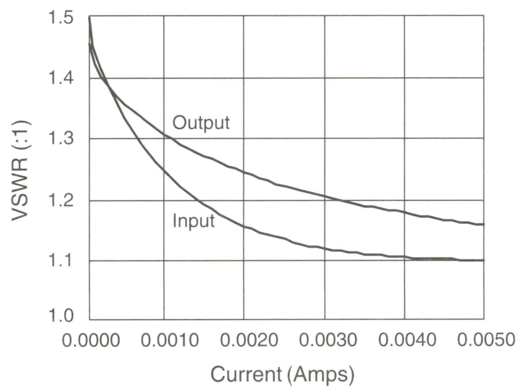
Attenuation vs. Current



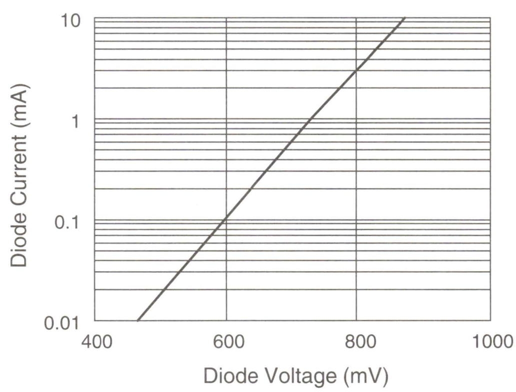
Input/Output VSWR vs. Current @ 900 MHz



Attenuation vs. Frequency

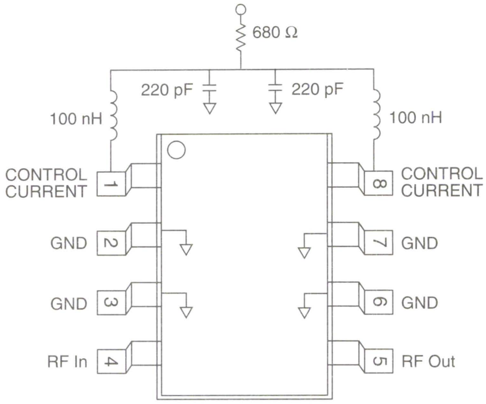


Input/Output VSWR vs. Current @ 1000 MHz

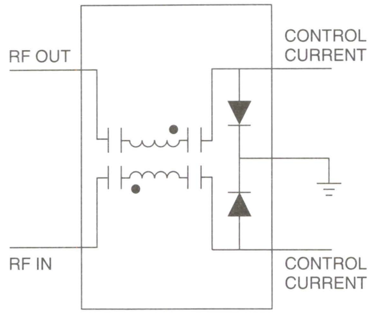


Typical PIN Diode Current vs. Voltage

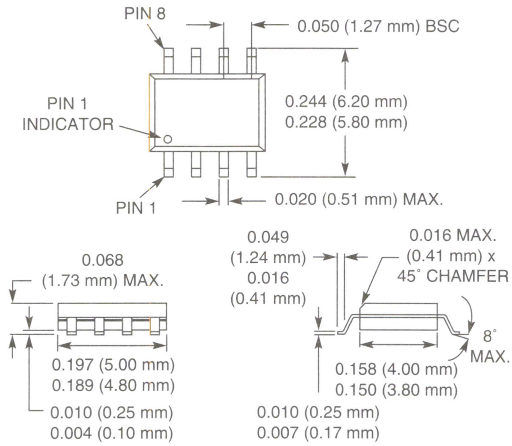
Pin Out



Connection Diagram



SOIC-8

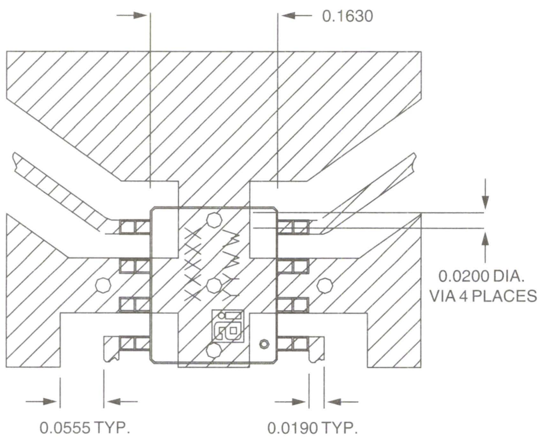


Absolute Maximum Ratings

Characteristic	Value
RF Input Power	0.5 W CW, 4 W @ 12.5% Duty Cycle
Control Current	50 mA per Diode
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +85°C
Maximum Reverse Diode Voltage	-10 V
Electrostatic Discharge	+125 V

Note: Operating this device above any of these parameters may cause irreversible damage.

Recommended Board Layout



Material is 10 mil FR4.

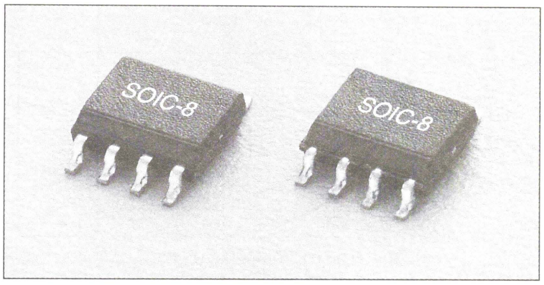
HIP3™ Variable Attenuator 1.70–2.00 GHz

SKYWORKS

AV102-12

Features

- +50 dBm IP3 Typical
- Low Loss 1 dB Typical
- Attenuation 30 dB Typical
- Good VSWR <1.5:1 Typical
- Small SOIC-8 Package



Description

The AV102-12 is a current controlled variable attenuator from Skyworks' series of HIP3™ components. It is designed to meet the wide dynamic range required in spread spectrum wireless base station applications. A monolithic quadrature hybrid is teamed with a silicon PIN diode pair in a plastic surface mount package reducing size and assuring consistency from part to part.

Electrical Specifications at 25°C

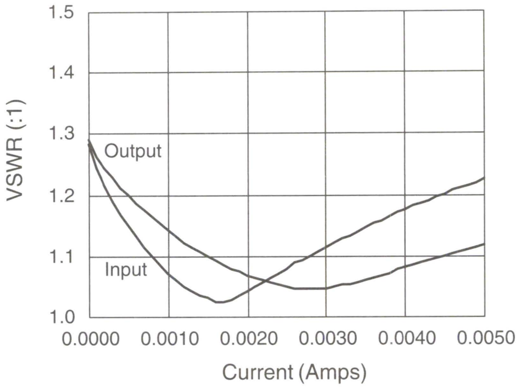
Parameter	Min.	Typ.	Max.	Unit
Frequency	1.70		2.00	GHz
Insertion Loss (0 mA Control Current)		1.0	1.5	dB
Attenuation @ 3.0 mA Control Current (1850 MHz)	18.5		25.0	dB
VSWR All Ports		1.5	1.8	
Input 3rd Order Intercept	+47	+50		dBm
Group Delay		0.6	1.0	ns

Operating Characteristics at 25°C (0, +5 V)

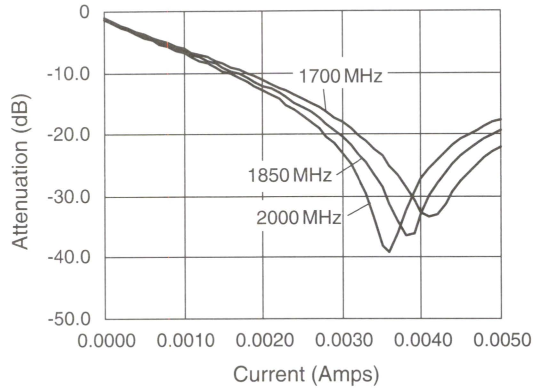
Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[2]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru (Peak)				5 8 2	µs µs mV
Maximum Input Power for <1 dB Attenuation Variation				+15		dBm

1. All measurements made in a 50 Ω system, unless otherwise specified.
2. 0–4 mA square wave total control current.

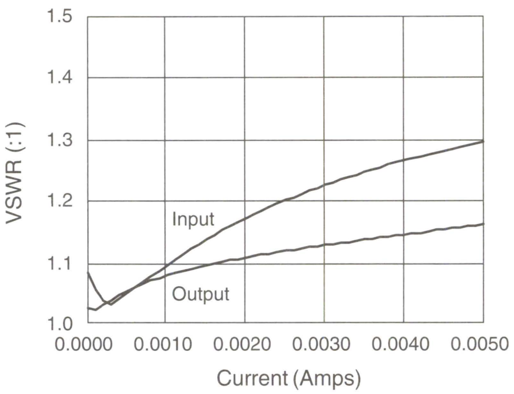
Typical Performance Data



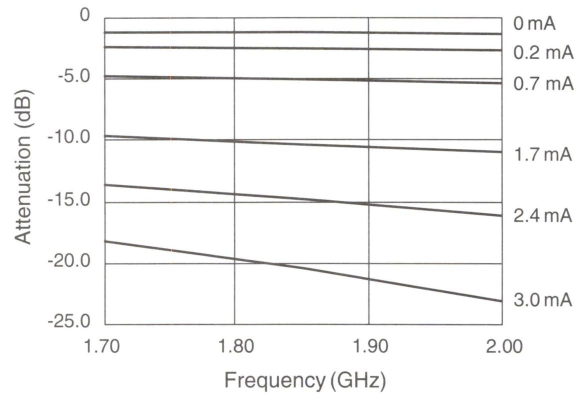
Input/Output VSWR vs. Current @ 1700 MHz



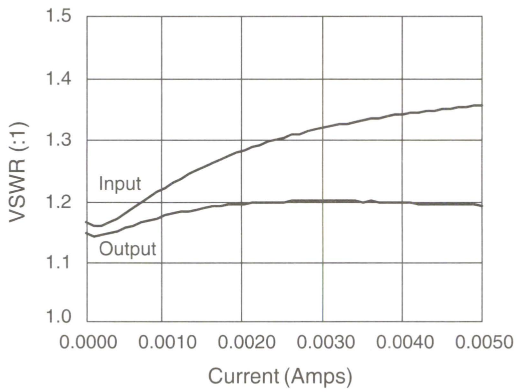
Attenuation vs. Current



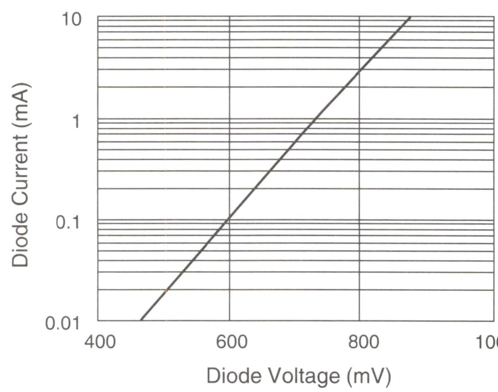
Input/Output VSWR vs. Current @ 1850 MHz



Attenuation vs. Frequency

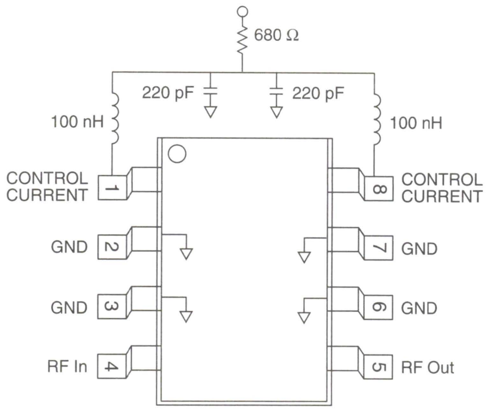


Input/Output VSWR vs. Current @ 2000 MHz

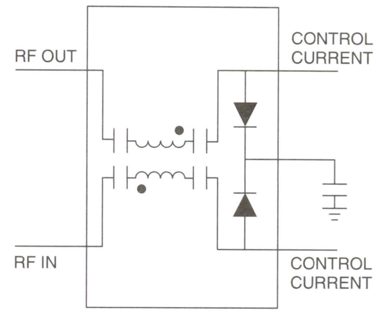


Typical PIN Diode Current vs. Voltage

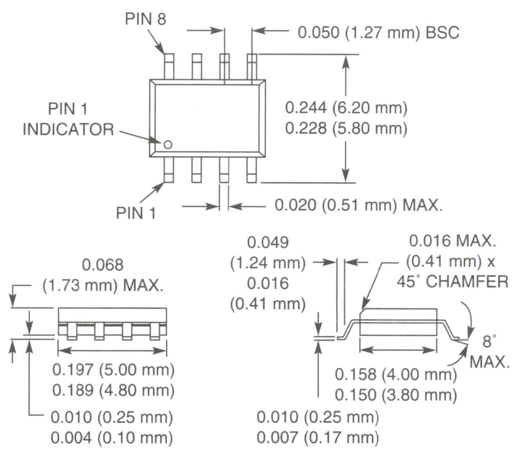
Pin Out



Connection Diagram



SOIC-8

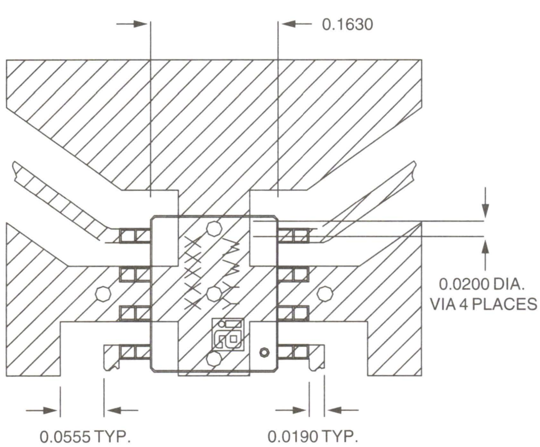


Absolute Maximum Ratings

Characteristic	Value
RF Input Power	.5 W CW, 4 W @ 12.5% Duty Cycle
Control Current	50 mA Each Diode
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +85°C
Maximum Reverse Diode Voltage	-10 V
Electrostatic Discharge	+125 V

Note: Operating this device above any of these parameters may cause irreversible damage.

Recommended Board Layout

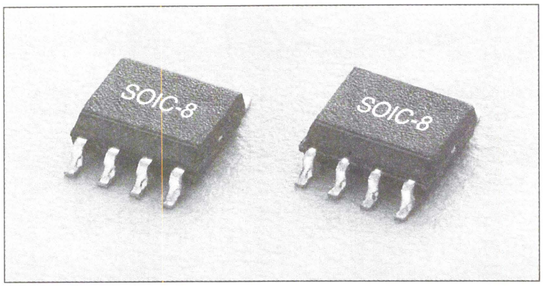


Material is 10 mil FR4.

HIP3™ Variable Attenuator 0.80–1.00 GHz

SKYWORKS

AV111-12



Features

- +40 dBm IP3 Typical
- Low Loss 1 dB Typical
- Attenuation 30 dB Typical
- Good VSWR <1.5:1 Typical
- Low Phase Shift

Description

The AV111-12 is a current controlled variable attenuator from Skyworks' series of HIP3™ components. It is designed to meet the wide dynamic range required in spread spectrum wireless base station applications. A monolithic quadrature hybrid is teamed with a silicon PIN diode pair in a plastic surface mount package reducing size and assuring consistency from part to part.

Electrical Specifications at 25°C

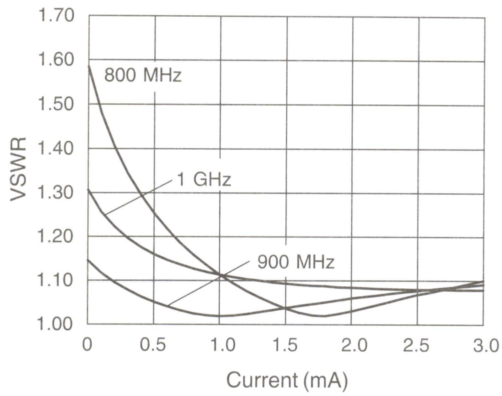
Parameter	Min.	Typ.	Max.	Unit
Frequency	0.80		1.0	GHz
Insertion Loss (0 mA Control Current)		1.0	1.5	dB
Attenuation @ 1.2 mA Control Current (900 MHz)	17.5		21.5	dB
VSWR All Ports		1.5	1.8	
Input 3rd Order Intercept	+37	+40		dBm
Relative Phase Shift Up to 20 dB Attenuation[1]		7	10	Deg.
Group Delay		0.4	0.9	ns

Operating Characteristics at 25°C (0, +5 V)

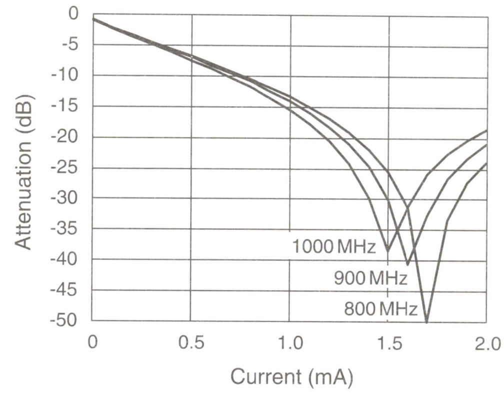
Parameter[2]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[3]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru (Peak)				5 8 5	µs µs mV
Maximum Input Power for <1 dB Attenuation Variation					+15	dBm

1. When built with external components as shown in the Pin Out diagram.
2. All measurements made in a 50 Ω system, unless otherwise specified.
3. 0–4 mA square wave total control current.

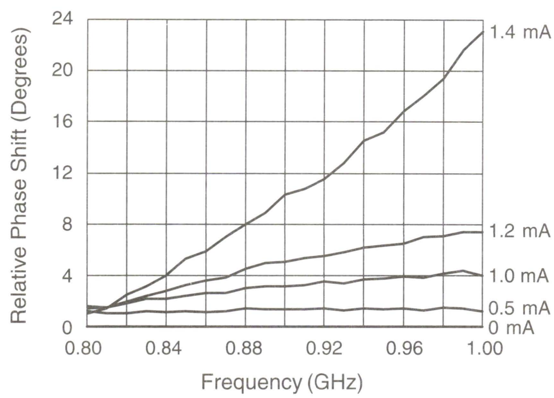
Typical Performance Data



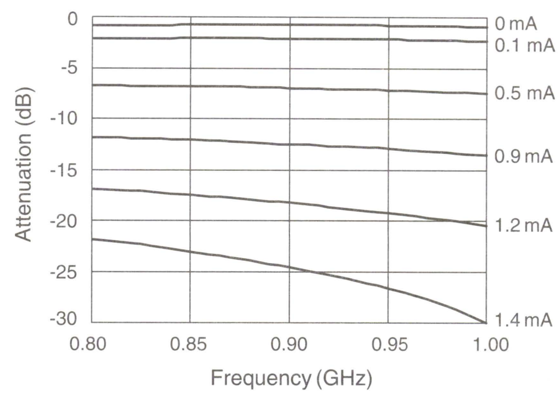
Input/Output VSWR vs. Current



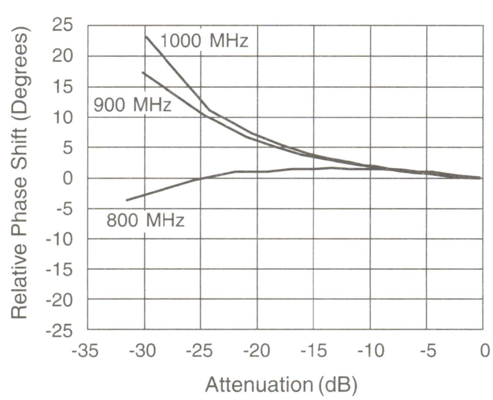
Attenuation vs. Current



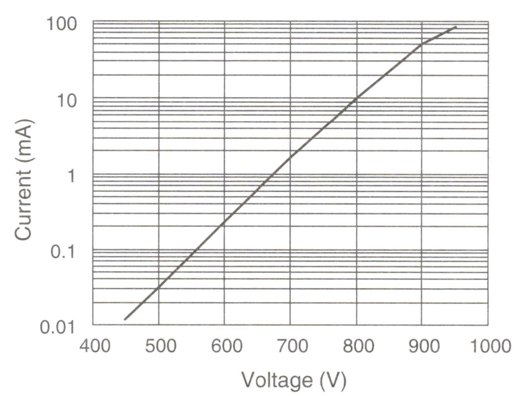
Relative Phase vs. Frequency



Attenuation vs. Frequency

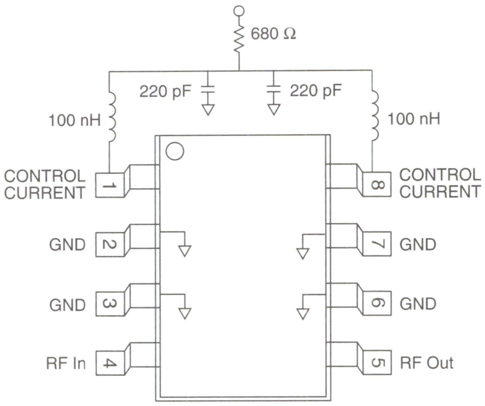


Relative Phase vs. Attenuation

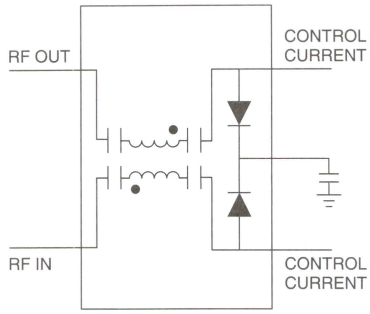


Typical PIN Diode Current vs. Voltage

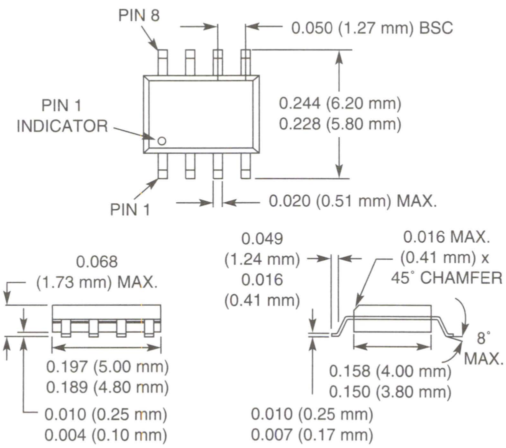
Pin Out



Connection Diagram



SOIC-8

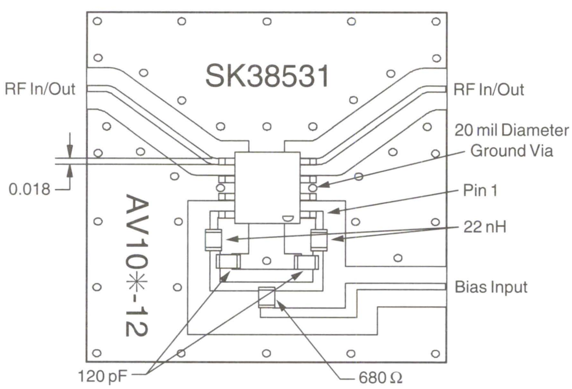


Absolute Maximum Ratings

Characteristic	Value
RF Input Power	0.5 W CW, 4 W @ 12.5% Duty Cycle
Control Current	50 mA per Diode
Operating Temperature	-65 to +125°C
Storage Temperature	-65 to +125°C
Maximum Reverse Diode Voltage	-100 V
Electrostatic Discharge	+125 V

Note: Operating this device above any of these parameters may cause irreversible damage.

Recommended Board Layout



Material is 10 mil FR4.

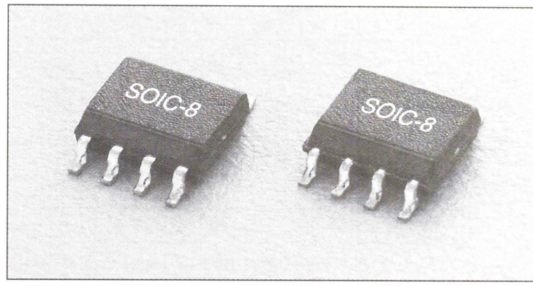
HIP3™ Variable Attenuator 1.7–2.0 GHz

SKYWORKS

AV112-12

Features

- Specified Attenuation: 17.5–25 dB
- Total Attenuation: 30 dB Typical
- Low Insertion Loss: < 1.5 dB
- Low Distortion: +40 dBm Typical
- Low Phase Shift and Delay



Description

The AV112-12 is a low distortion, PIN diode variable attenuator in a small SOIC-8 package. The design is based on Skyworks' unique series of HIP3™ components. The AV112-12 consists of a monolithic quadrature hybrid and a matched pair of PIN diodes designed for low distortion attenuators.

Electrical Specifications at 25°C

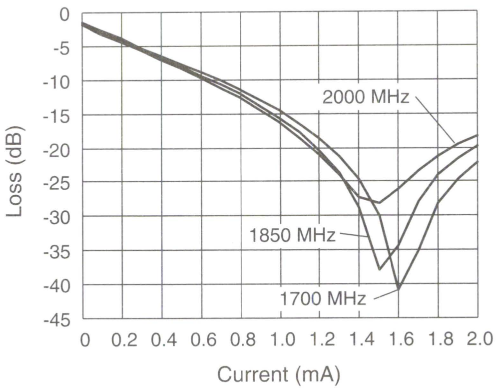
Parameter	Min.	Typ.	Max.	Unit
Frequency	1.7		2.0	GHz
Insertion Loss (0 mA Control Current)		1.0	1.5	dB
Attenuation @ 1.2 mA Control Current (1.85 GHz)	17.5		25.0	dB
SWR (All Ports)		1.5	1.8	
Input 3rd Order Intercept Point	+37	+40		dBm
Relative Phase Shift Up to 20 dB Attenuation		7	10	Deg.
Group Delay		0.6	0.9	ns

Operating Characteristics at 25°C (0, +5 V)

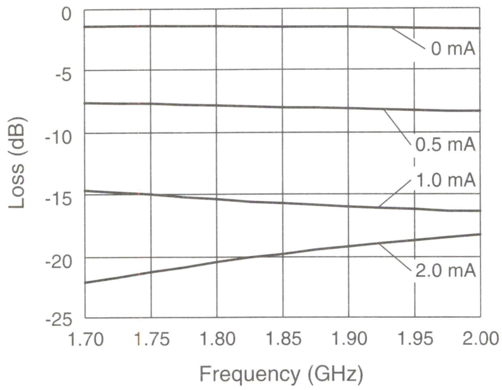
Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[2]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru (Peak)				5 8 5	µs µs mV
Maximum Input Power for < 1 dB Attenuation Variation					+15	dBm

1. All measurements made in a 50 Ω system.
2. Driver Pulse — 0–4 mA square wave.

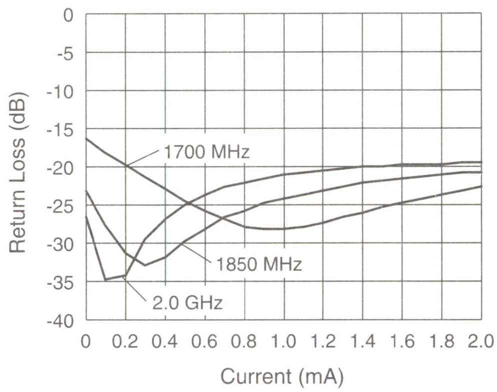
Typical Performance Data



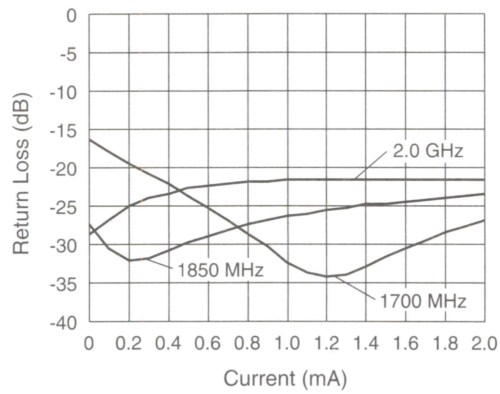
Attenuation vs. Control Current



Attenuation vs. Frequency



Input Return vs. Current Control



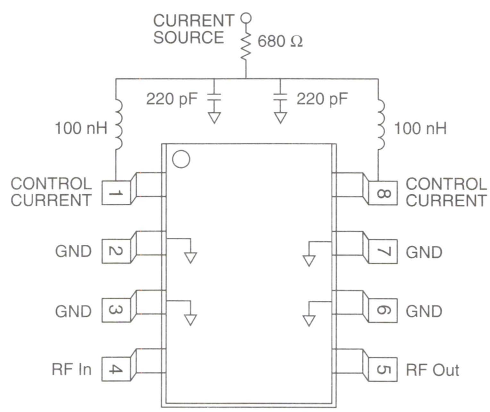
Output Return vs. Current Control

Absolute Maximum Ratings

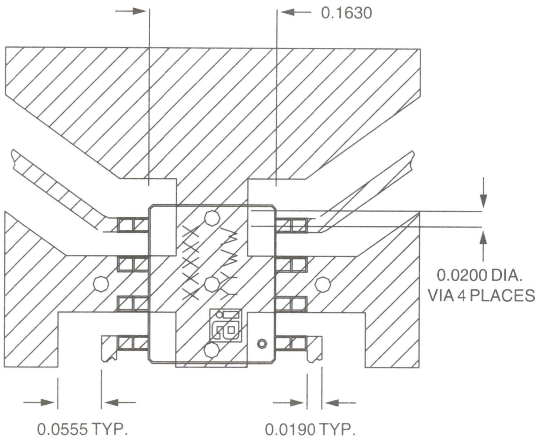
Characteristic	Value
RF Input Power	0.5 W CW, 4 W @ 12.5% Duty Cycle
Control Current	50 mA per Diode
Operating Temperature	-65 to +125°C
Storage Temperature	-65 to +125°C
Maximum Reverse Diode Voltage	-100 V
Electrostatic Discharge	+125 V

Note: Operating this device above any of these parameters may cause irreversible damage.

Pin Out

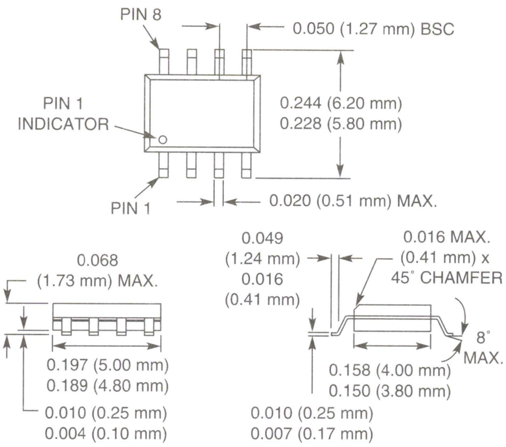


Recommended Board Layout

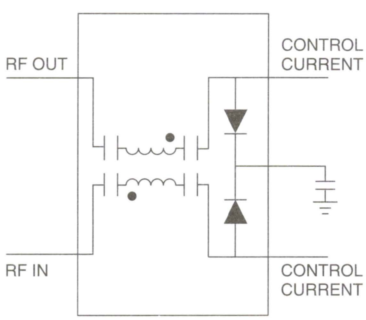


Material is 10 mil FR4.

SOIC-8



Connection Diagram



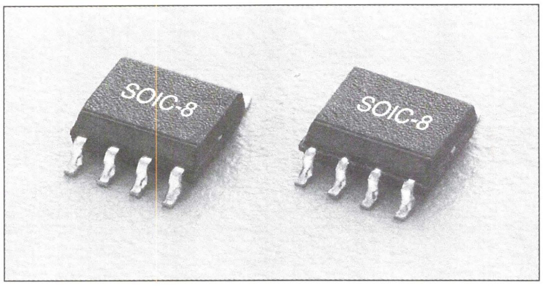
HIP3™ Variable Attenuator 2.10–2.30 GHz

SKYWORKS

AV113-12

Features

- Low Loss 1.4 dB Typical
- Attenuation 18 dB Typical
- Good VSWR <1.5:1 Typical
- Small SOIC-8 Package
- For IMT-2000 Applications



Description

The AV113-12 is a current controlled variable attenuator from Skyworks' series of HIP3™ components. It is designed to meet the wide dynamic range required in IMT-2000 applications. A monolithic quadrature hybrid is teamed with a silicon PIN diode pair in a plastic surface mount package reducing size and assuring consistency from part to part.

Electrical Specifications at 25°C

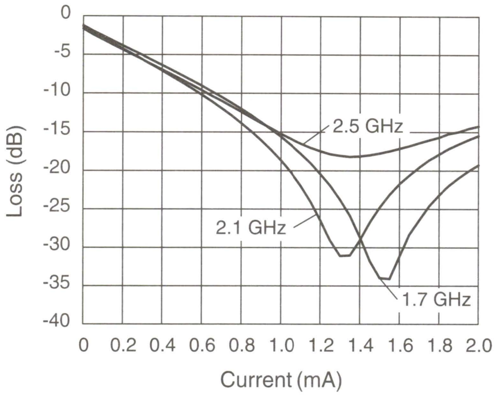
Parameter	Min.	Typ.	Max.	Unit
Frequency	2.1		2.3	GHz
Insertion Loss (0 mA Control Current)		1.4	1.6	dB
Attenuation @ 1.0 mA Control Current	16.5	18		dB
VSWR All Ports		1.5		
Input 3rd Order Intercept Point		40		dBm
Group Delay		0.4	0.8	ns

Operating Characteristics at 25°C (0, +5 V)

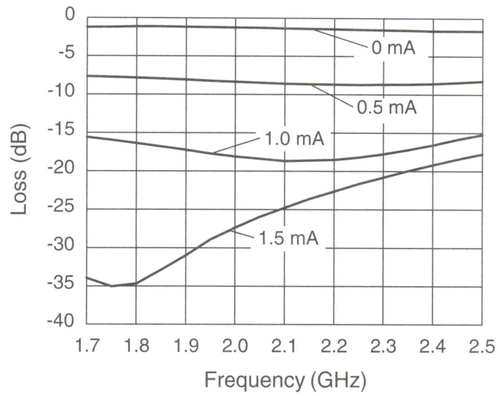
Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics[2]	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru (Peak)				5 8 2	µs µs mV
Maximum Input Power for <1 dB Attenuation Variation				+15		dBm

1. All measurements made in a 50 Ω system, unless otherwise specified.
2. 0–4 mA square wave total control current.

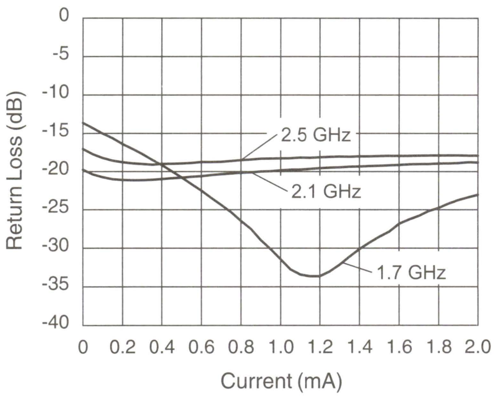
Typical Performance Data



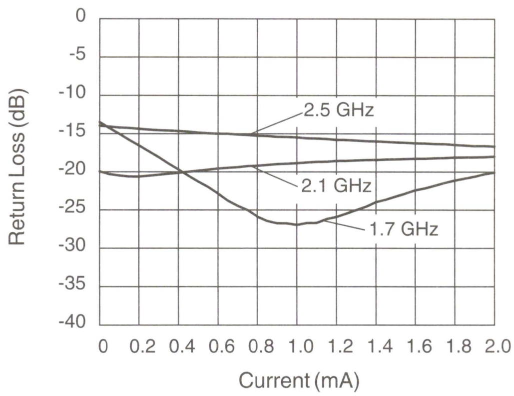
Attenuation vs. Control Current



Attenuation vs. Frequency



Input Return Loss vs. Current Control



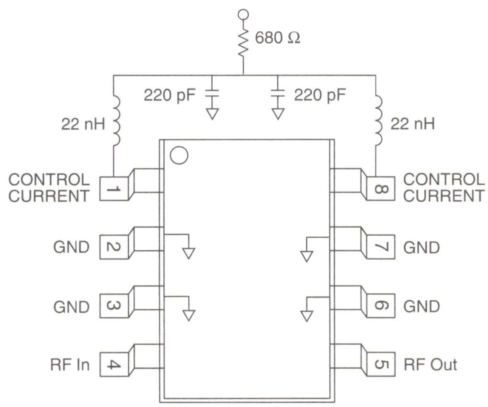
Output Return Loss vs. Current Control

Absolute Maximum Ratings

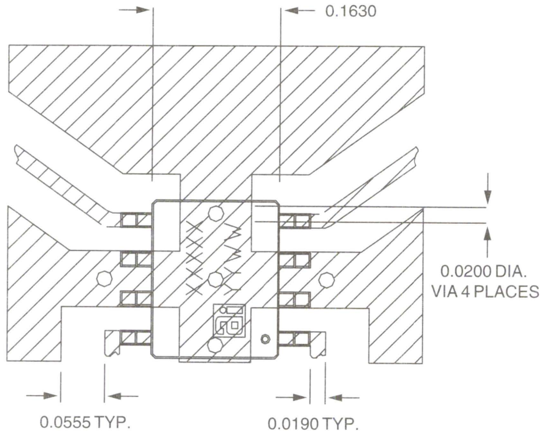
Characteristic	Value
RF Input Power	0.5 W CW, 4 W @ 12.5% Duty Cycle
Control Current	50 mA per Diode
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +85°C
Maximum Reverse Diode Voltage	-10 V
Electrostatic Discharge	+125 V

Note: Operating this device above any of these parameters may cause irreversible damage.

Pin Out

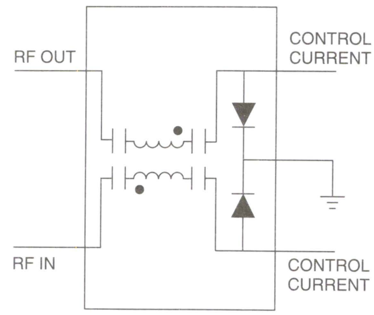


Recommended Board Layout

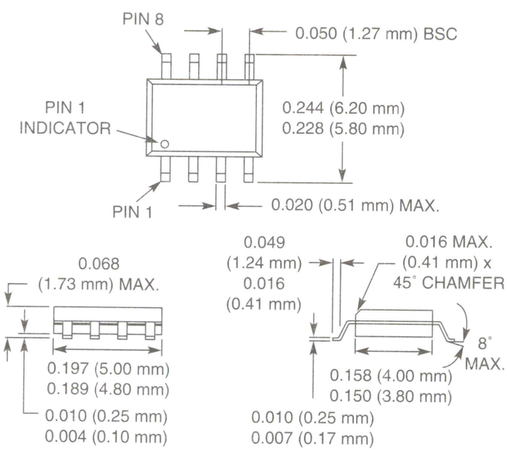


Material is 10 mil FR4.

Connection Diagram



SOIC-8



Preliminary

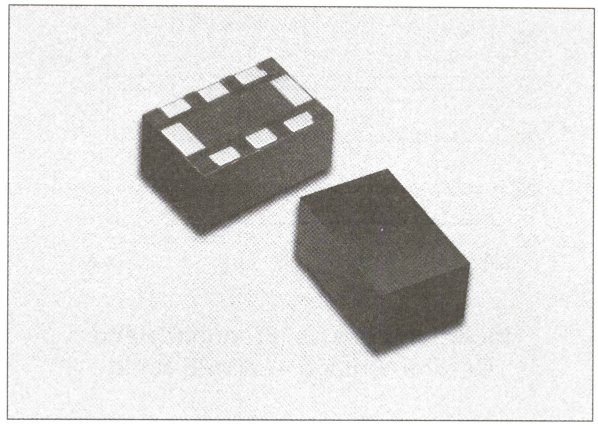
HIP3™ Variable Attenuator for AMPS and GSM Base Stations

SKYWORKS

AV131-315

Features

- 23 dB Attenuation Range
- 1.5 dB Insertion Loss, 1.5 SWR
- 0–12 V Control Voltage
- 43 dBm IP3
- Small Footprint LGA Package
- Designed for AMPS and GSM Base Stations



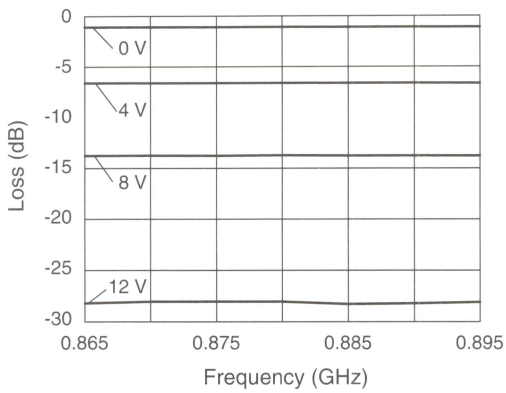
Description

The AV131-315 is a voltage controlled variable attenuator from Skyworks' series of HIP3™ components. It is specifically designed and specified for use as a wide dynamic range low distortion attenuator for AMPS and GSM base station applications centered at 881.5 MHz and 942.5 MHz. The AV131-315 employs a monolithic quadrature hybrid and a pair of silicon PIN diodes to achieve the specified low distortion performance. It operates from 0–12 V at 1.6 mA typical control current at maximum attenuation. The AV131-315 is packaged in a small outline LGA (Land Grid Array) surface mount package with the internal elements affixed to an organic BT substrate.

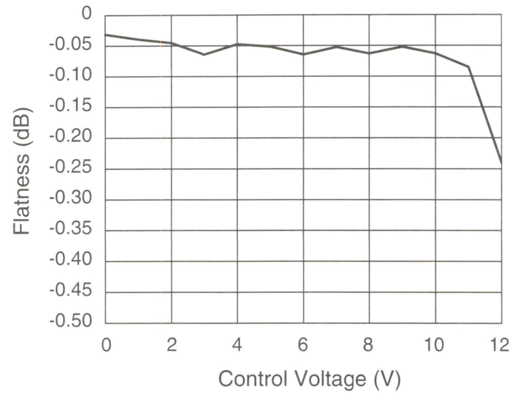
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
AMPS Frequency Range (BW)		869		894	MHz
GSM Frequency Range (BW)		925		960	MHz
Control Voltage (C_V) Range		0		12	V
Insertion Loss in BW	C_V = 0 V			1.5	dB
Attenuation Range	At F_O, C_V = 10 V At F_O, C_V = 12 V	18 23		22 –	dB dB
VSWR in BW				1.5	
IP3	900/905 MHz, C_V = 0 V	43			dBm
IM3	8 dBm			-70	dBc

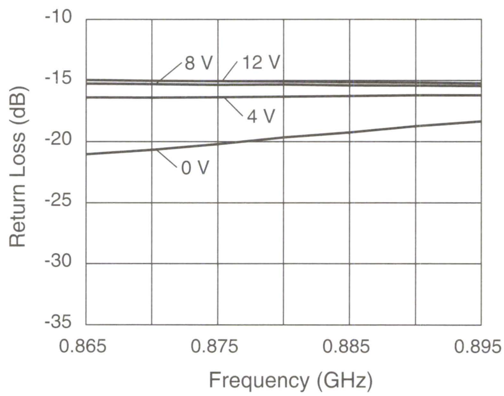
Typical Performance Data



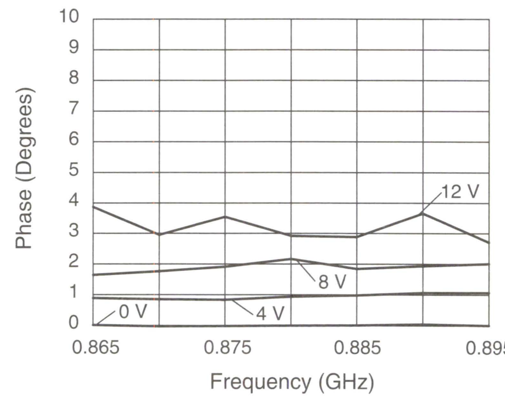
Insertion Loss vs. Frequency and Control Voltage — AMPS Band



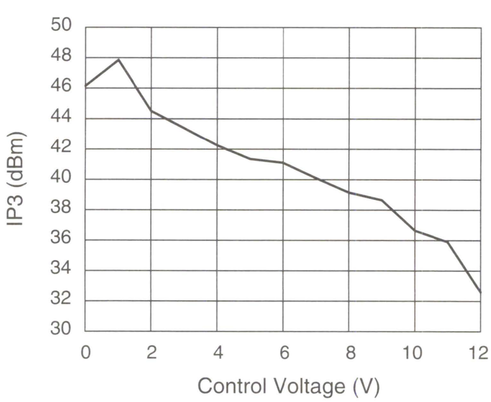
Insertion Loss Flatness vs. Control Voltage — AMPS Band



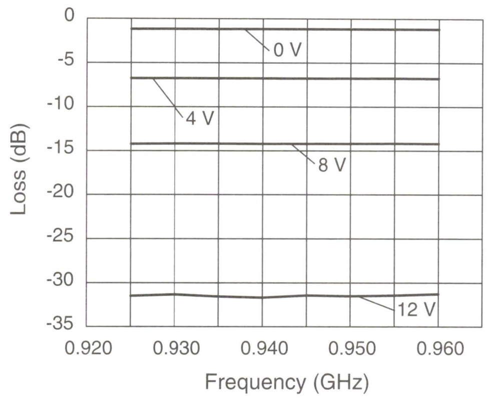
Input/Output Return Loss vs. Frequency and Control Voltage — AMPS Band



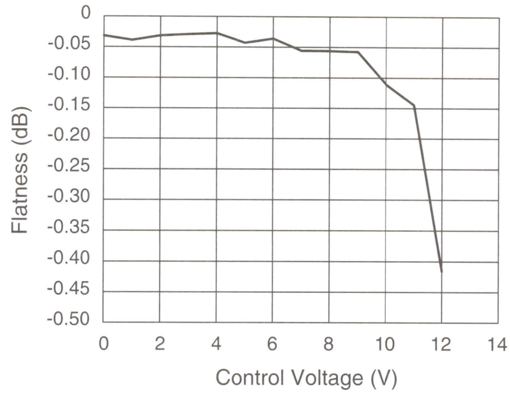
Phase vs. Frequency and Control Voltage — AMPS Band



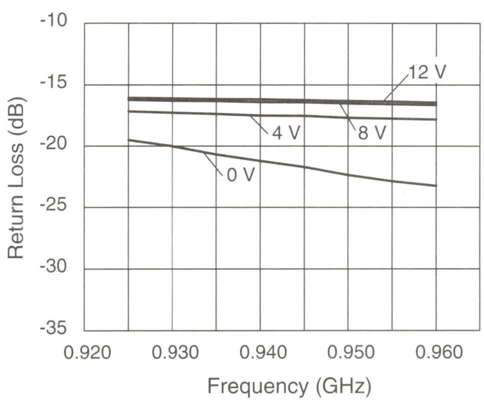
3rd Order Intermod vs. Control Voltage
RF_1 = 0.900 GHz, RF_2 = 0.905 GHz @ 8 dBm



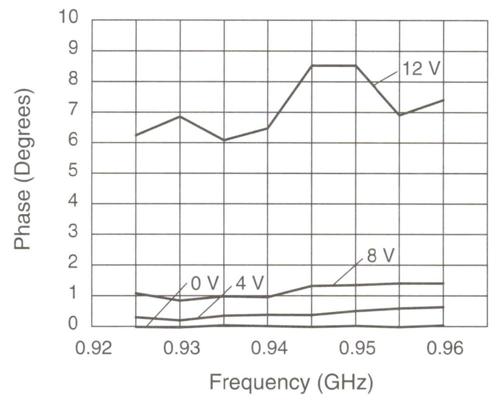
Insertion Loss vs. Frequency and Control Voltage — GSM Band



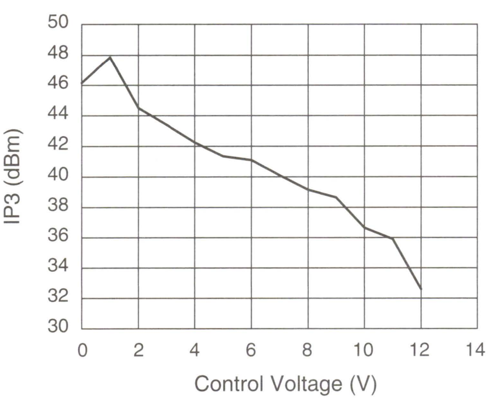
Insertion Loss Flatness vs. Control Voltage — GSM Band



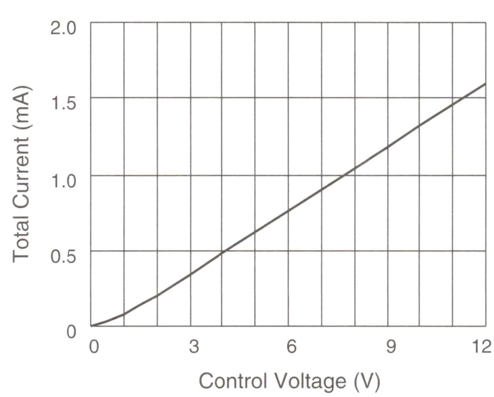
Input/Output Return Loss vs. Frequency and Control Voltage — GSM Band



Phase vs. Frequency and Control Voltage — GSM Band

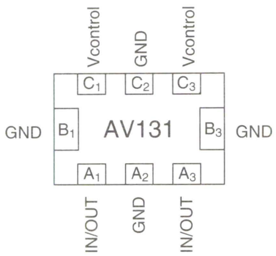


3rd Order Intermod vs. Control Voltage
RF_1 = 0.900 GHz, RF_2 = 0.905 GHz @ 8 dBm



Total Current vs. Control Voltage

Pin Out (Bottom View)



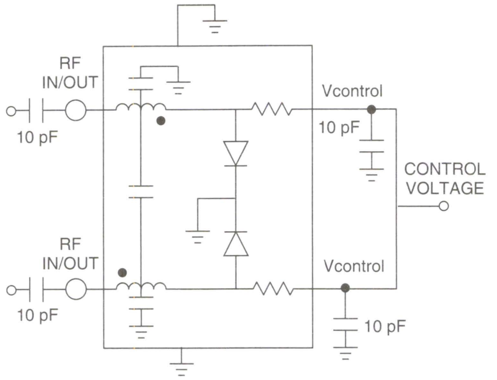
Terminal No.	Terminal Name
A_1 (Pin 1)	IN/OUT
A_2	GND
A_3	IN/OUT
B_1	GND
B_3	GND
C_1	Vcontrol
C_2	GND
C_3	Vcontrol

Absolute Maximum Ratings

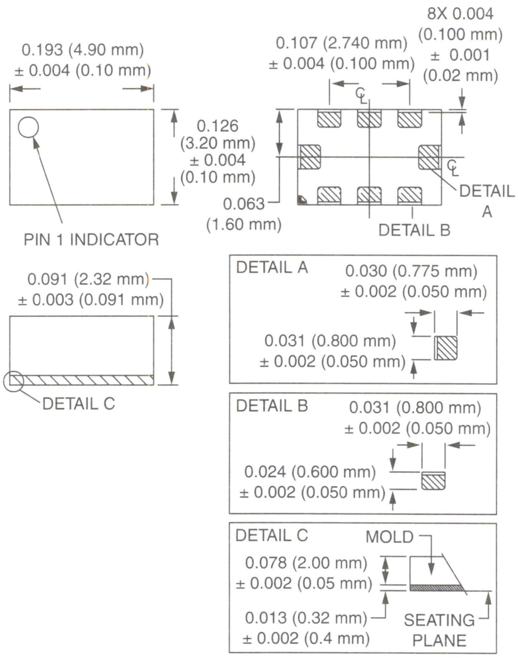
Characteristic	Value
RF Input Power	0.5 W CW, 4 W @ 12.5% Duty Cycle
Control Voltage	15 V
Control Current	50 mA Each Diode
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +85°C
Maximum Reverse Diode Voltage	-10 V
Electrostatic Discharge	+125 V

Note: Operating this device above any of these parameters may cause irreversible damage.

Connection Diagram



-315



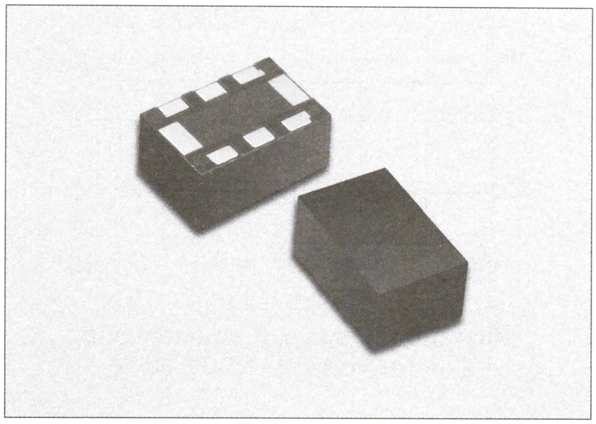
HIP3™ Variable Attenuator for DCS and PCS Base Stations

SKYWORKS

AV132-315

Features

- 23 dB Attenuation Range
- 1.5 dB Insertion Loss, 1.5 SWR
- 0–12 V Control Voltage
- 43 dBm IP3
- Small Footprint LGA Package
- Designed for DCS/PCS Base Station Applications



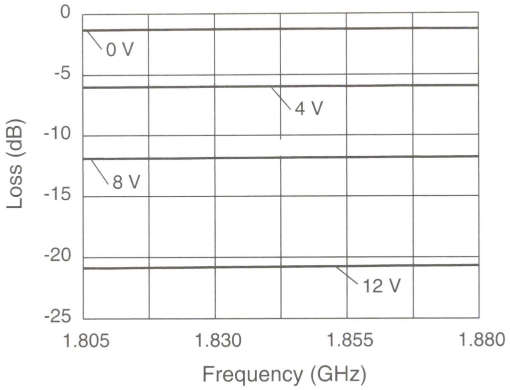
Description

The AV132-315 is a voltage controlled variable attenuator from Skyworks' series of HIP3™ components. It is specifically designed and specified for use as a wide dynamic range low distortion attenuator for DCS and PCS base station applications centered at 1837.5 MHz and 1960 MHz. The AV132-315 employs a monolithic quadrature hybrid and a pair of silicon PIN diodes to achieve the specified low distortion performance. It operates from 0–12 V with 1.6 mA typical control current at maximum attenuation. The AV132-315 is packaged in a small outline LGA (Land Grid Array) surface mount package with the internal elements affixed to an organic BT substrate.

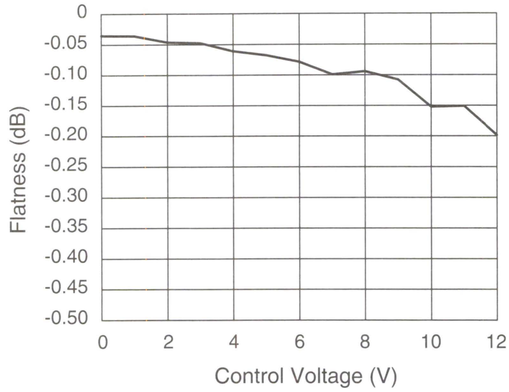
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
DCS Frequency Range (BW)		1805		1870	MHz
PCS Frequency Range (BW)	F_O ± 30.0 MHz	1930		1990	MHz
Control Voltage (C_V) Range		0		12	V
Insertion Loss in BW	C_V = 0 V			1.5	dB
Attenuation Range	At F_O, C_V = 10 V At F_O, C_V = 12 V	18 23		22 –	dB dB
VSWR in BW				1.5	
IP3	1900/1905 MHz, C_V = 0 V	43			dBm
IM3	8 dBm			-70	dBc

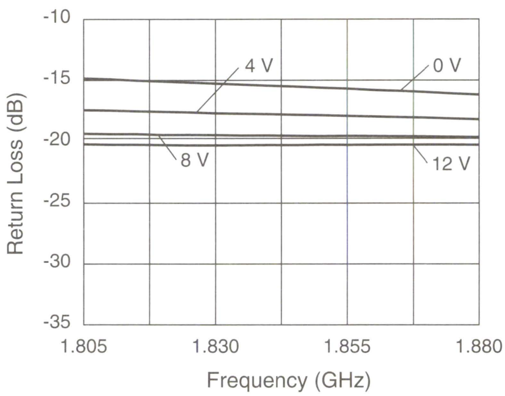
Typical Performance Data



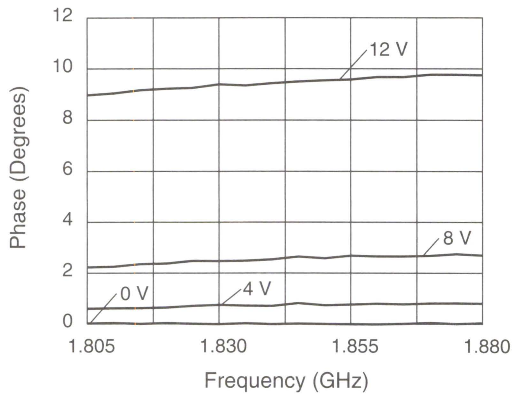
Insertion Loss vs. Frequency and Control Voltage — DCS Band



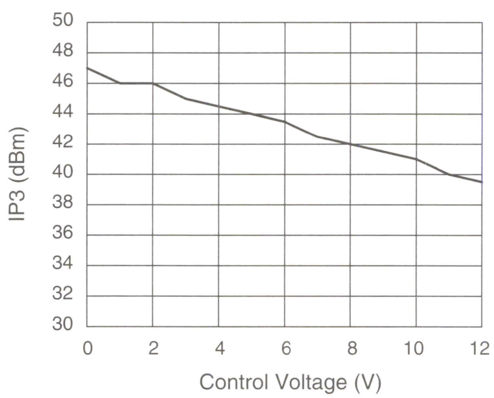
Insertion Loss Flatness vs. Control Voltage — DCS Band



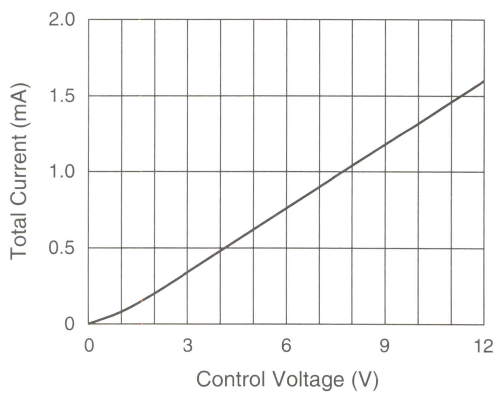
Input/Output Return Loss vs. Frequency and Control Voltage — DCS Band



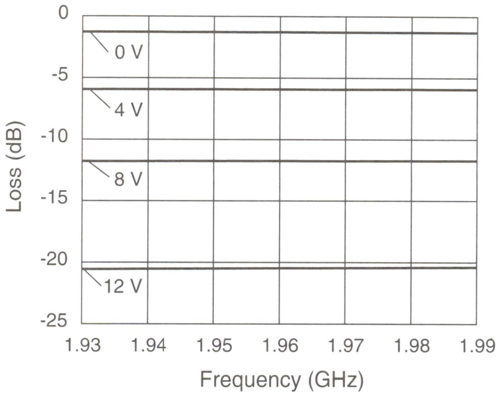
Phase vs. Frequency and Control Voltage — DCS Band



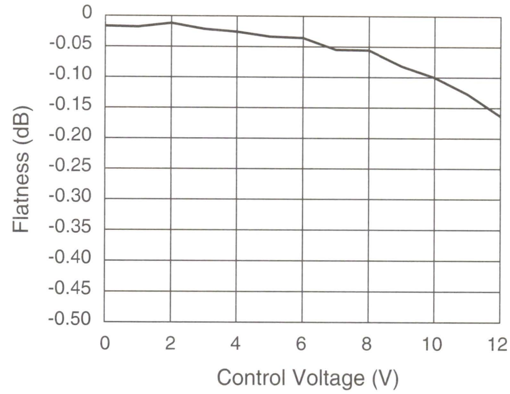
IP3 vs. Control Voltage
RF_1 = 1.900 GHz, RF_2 = 1.905 GHz @ 8 dBm



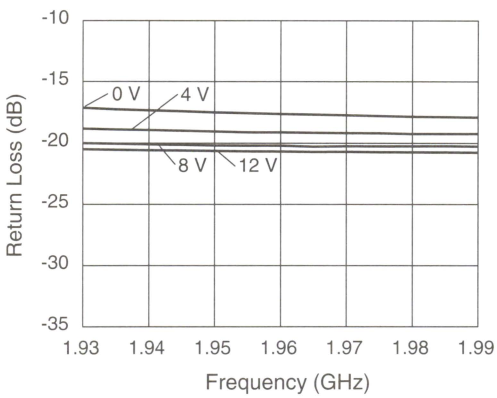
Total Current vs. Control Voltage



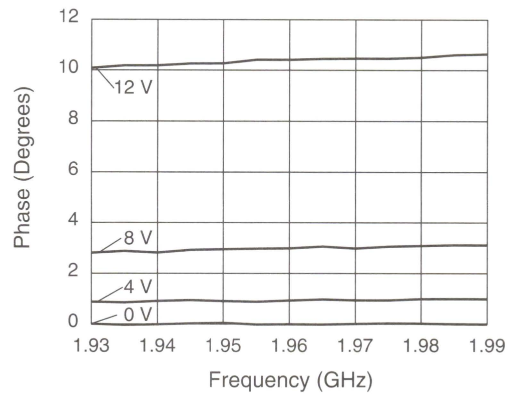
Insertion Loss vs. Frequency and Control Voltage — PCS Band



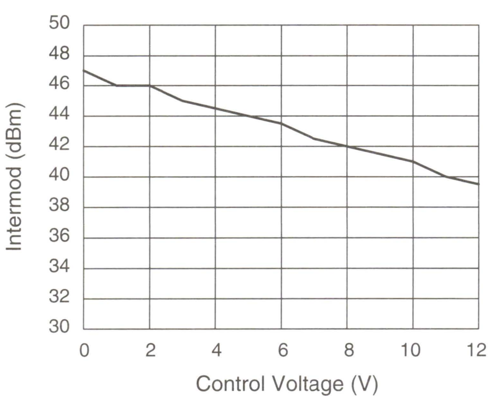
Insertion Loss Flatness vs. Control Voltage — PCS Band



Input/Output Return Loss vs. Frequency and Control Voltage — PCS Band

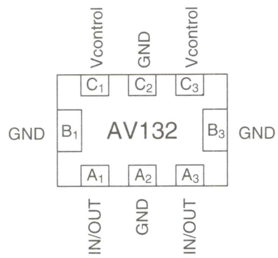


Phase vs. Frequency and Control Voltage — PCS Band



3rd Order Intermod vs. Control Voltage
RF_1 = 1.900 GHz, RF_2 = 1.905 GHz @ 8 dBm

Pin Out (Bottom View)



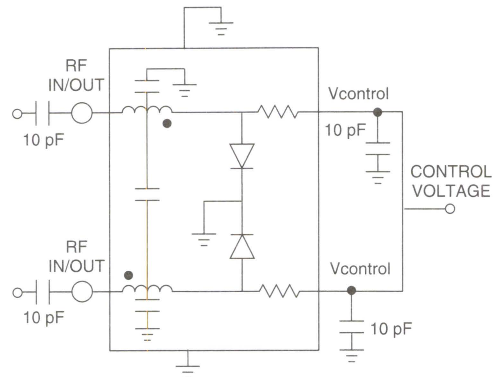
Terminal No.	Terminal Name
A_1 (Pin 1)	IN/OUT
A_2	GND
A_3	IN/OUT
B_1	GND
B_3	GND
C_1	Vcontrol
C_2	GND
C_3	Vcontrol

Absolute Maximum Ratings

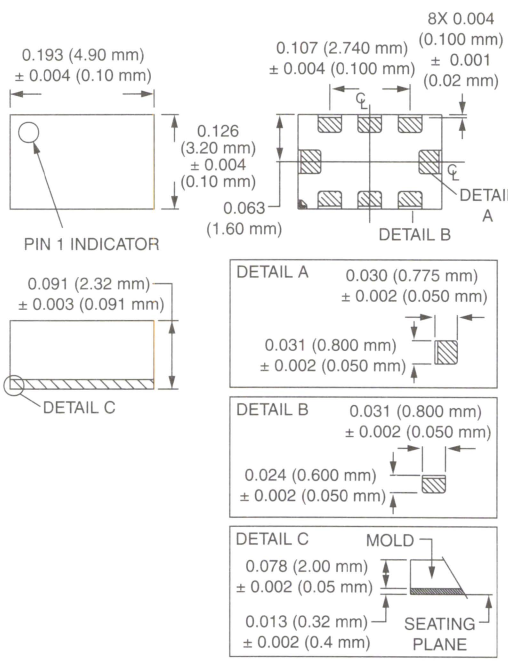
Characteristic	Value
RF Input Power	0.5 W CW, 4 W @ 12.5% Duty Cycle
Control Voltage	15 V
Control Current	50 mA Each Diode
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +85°C
Maximum Reverse Diode Voltage	-10 V
Electrostatic Discharge	+125 V

Note: Operating this device above any of these parameters may cause irreversible damage.

Connection Diagram



-315



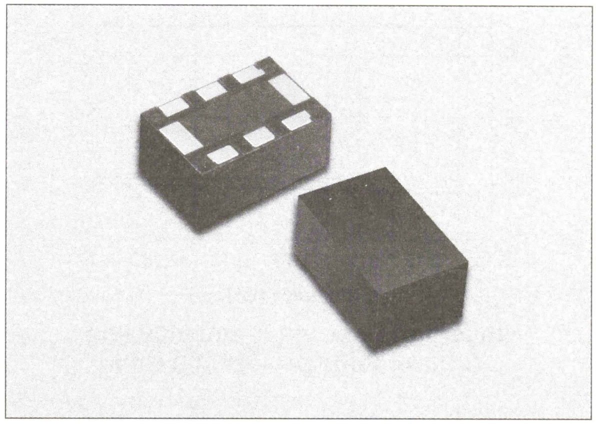
HIP3™ Variable Attenuator for UMTS Base Stations

SKYWORKS

AV133-315

Features

- 23 dB Attenuation Range
- 1.5 dB Insertion Loss, 1.5 SWR
- 0–12 V Control Voltage
- 43 dBm IP3
- Small Footprint LGA Package
- Designed for UMTS Base Stations



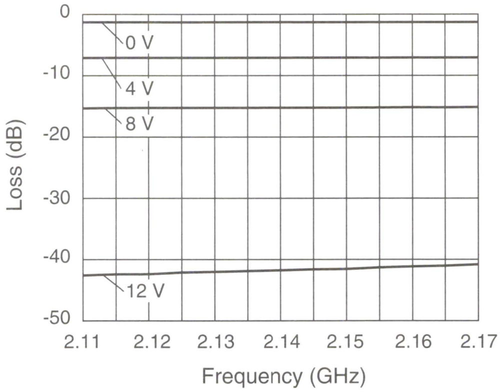
Description

The AV133-315 is a voltage controlled variable attenuator from Skyworks' series of HIP3™ components. It is specifically designed and specified for use as a wide dynamic range low distortion attenuator for UMTS base station applications centered at 2140 MHz. The AV133-315 employs a monolithic quadrature hybrid and a pair of silicon PIN diodes to achieve the specified low distortion performance. It operates from 0–12 V at 1.6 mA typical control current at maximum attenuation. The AV133-315 is packaged in a small outline LGA (Land Grid Array) surface mount package with the internal elements affixed to an organic BT substrate.

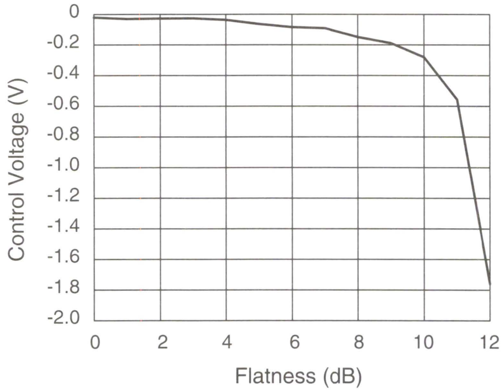
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
UMTS Frequency Range (BW)	F_O ± 12.5 MHz	2110		2170	MHz
Control Voltage (C_V) Range		0		12	V
Insertion Loss in BW	C_V = 0 V			1.5	dB
Attenuation Range	At F_O, C_V = 10 V At F_O, C_V = 12 V	18 23		22 –	dB dB
VSWR in BW				1.5	
IP3	2140/2145 MHz, C_V = 0 V	43			dBm
IM3	8 dBm			-70	dBc

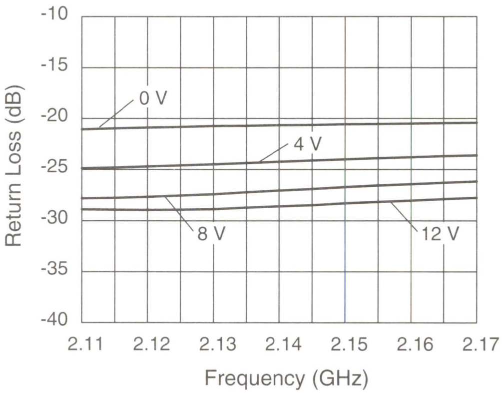
Typical Performance Data



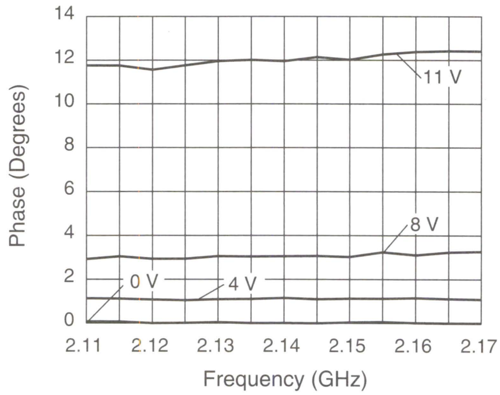
Insertion Loss vs. Frequency and Control Voltage — UMTS Band



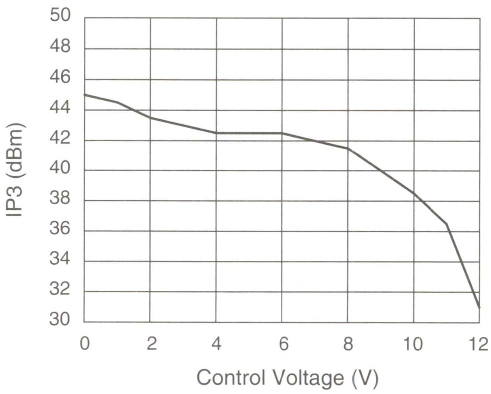
Insertion Loss Flatness vs. Control Voltage — UMTS Band



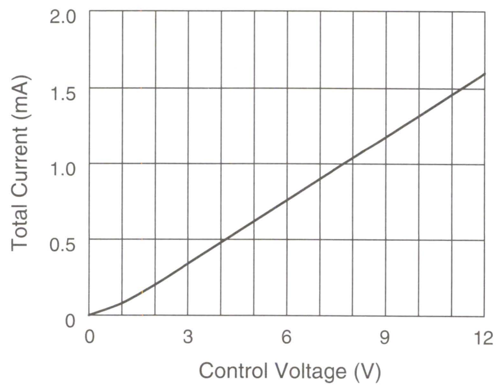
Input/Output Return Loss vs. Frequency and Control Voltage — UMTS Band



Phase vs. Frequency and Control Voltage — UMTS Band

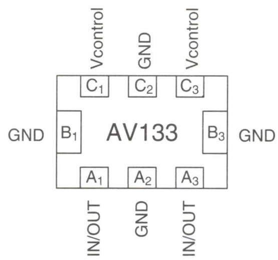


3rd Order Intermod Intercept vs. Control Voltage $RF_1 = 2.140$ GHz, $RF_2 = 2.145$ GHz @ 8 dBm



Total Current vs. Control Voltage

Pin Out (Bottom View)



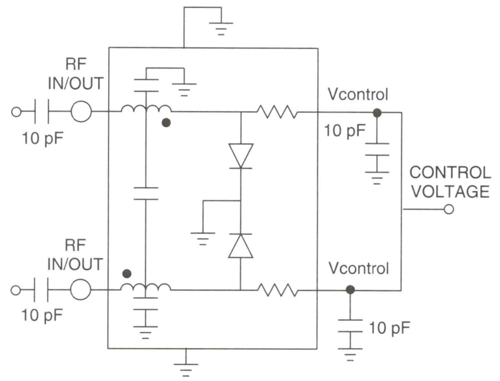
Terminal No.	Terminal Name
A_1 (Pin 1)	IN/OUT
A_2	GND
A_3	IN/OUT
B_1	GND
B_3	GND
C_1	Vcontrol
C_2	GND
C_3	Vcontrol

Absolute Maximum Ratings

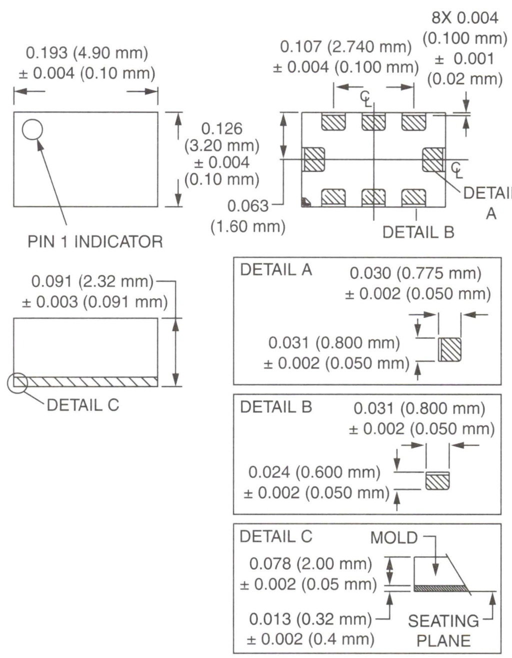
Characteristic	Value
RF Input Power	0.5 W CW, 4 W @ 12.5% Duty Cycle
Control Voltage	15 V
Control Current	50 mA Each Diode
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +85°C
Maximum Reverse Diode Voltage	-10 V
Electrostatic Discharge	+125 V

Note: Operating this device above any of these parameters may cause irreversible damage.

Connection Diagram



-315



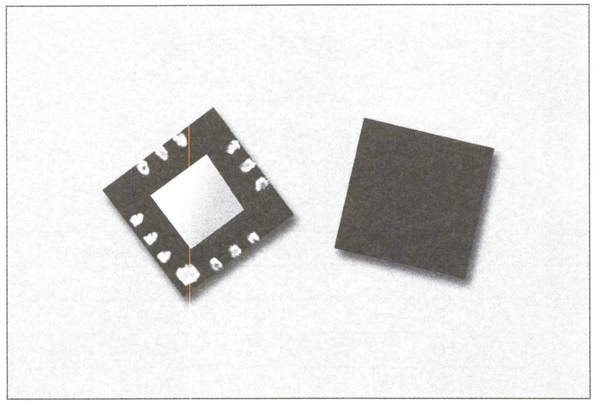
GaAs IC 25 dB Voltage Variable Attenuator 2.7–4.0 GHz

SKYWORKS

AV141-321

Features

- Power Control for 3.5 GHz Fixed Wireless Applications
- Minimum 25 dB Attenuation
- Positive 0.2–1.2 V Control Voltage
- QFN-12 3 x 3 mm Package
- Low Cost
- No External Components Needed



Description

The AV141-321 is a GaAs IC PHEMT voltage variable attenuator that has been designed for WLAN applications. Operating from 2.7–4.0 GHz, the AV141-321 is ideal for low cost applications such as 3.5 GHz fixed wireless LAN power control applications.

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	1 W Max.
Control Voltage	-0.2 V, +6 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

1. All measurements made in a 50 Ω system, unless otherwise specified.
2. For worst case state.

Electrical Specifications at 25°C

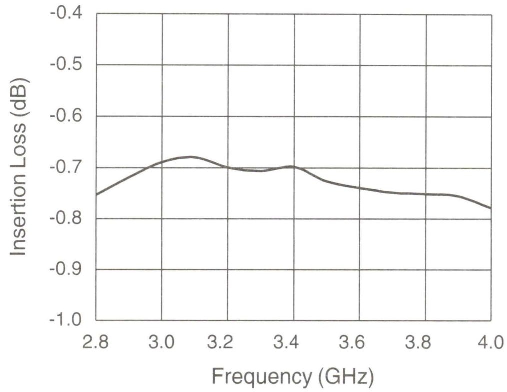
Parameter	Frequency	Min.	Typ.	Max.	Unit
Insertion Loss (V_C = 1.2 V)	2.7–4.0 GHz		0.7	1.0	dB
Maximum Attenuation (V_C = 0.2 V)	2.7–4.0 GHz	25	30		dB
VSWR — All Ports	2.7–4.0 GHz		1.5	1.8	

Operating Characteristics at 25°C (0, +1.2 V)

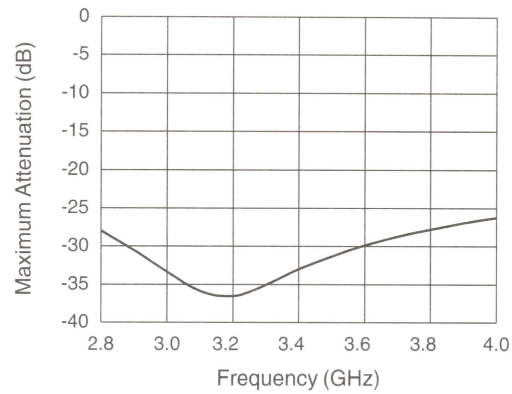
Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching Characteristics	Rise, Fall (10/90% or 90/10% RF) On, Off (50% CTL to 90/10% RF) Video Feedthru		80	50 150 25		ns ns mV
Maximum Input Power for < 1 dB Attenuation Variation		2.7–4.0 GHz		13		dBm
Input 3rd Order Intercept Point (IIP3)		2.7–4.0 GHz		20		dBm
Control Voltage			0.2		1.2	V

1. All measurements made in a 50 Ω system, unless otherwise specified.
2. For worst case state.

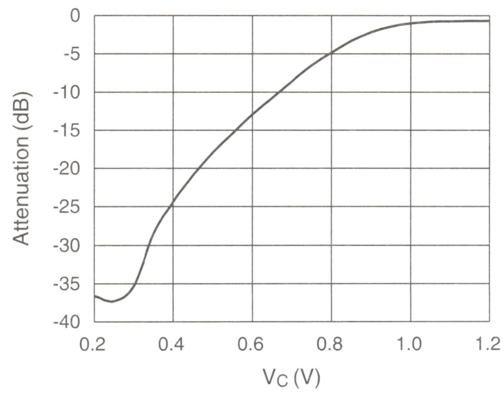
Typical Performance Data at 25°C



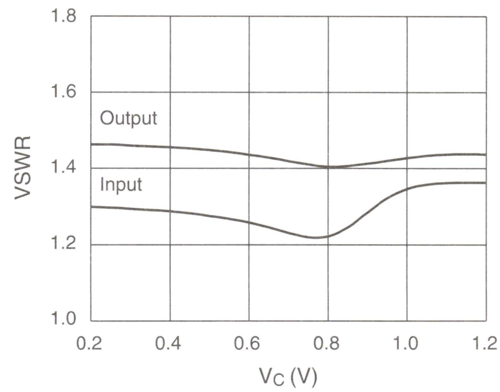
Insertion Loss vs. Frequency



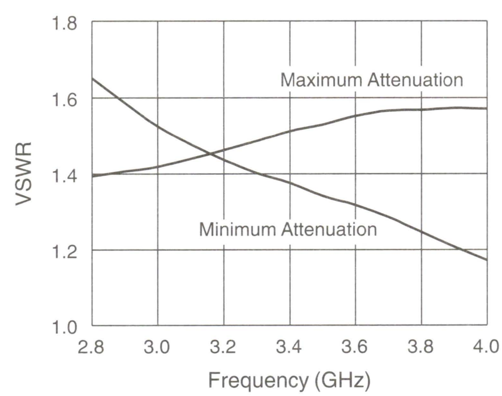
Maximum Attenuation vs. Frequency



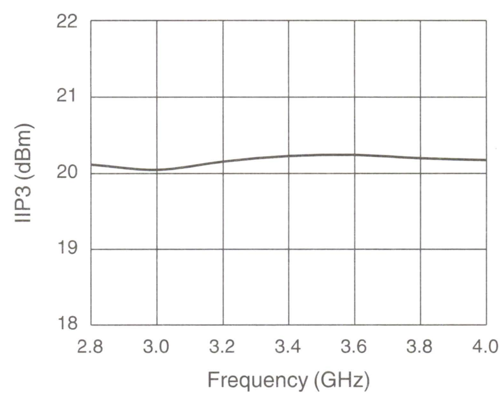
Attenuation vs. Control Voltage



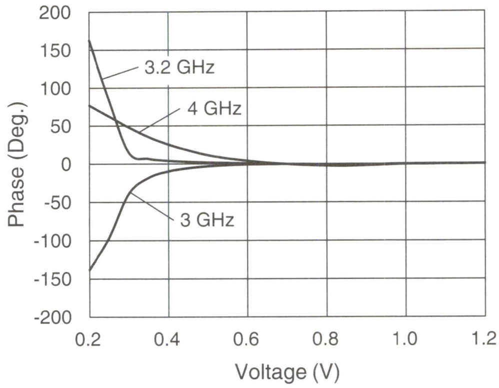
VSWR vs. Control Voltage



Output VSWR vs. Frequency

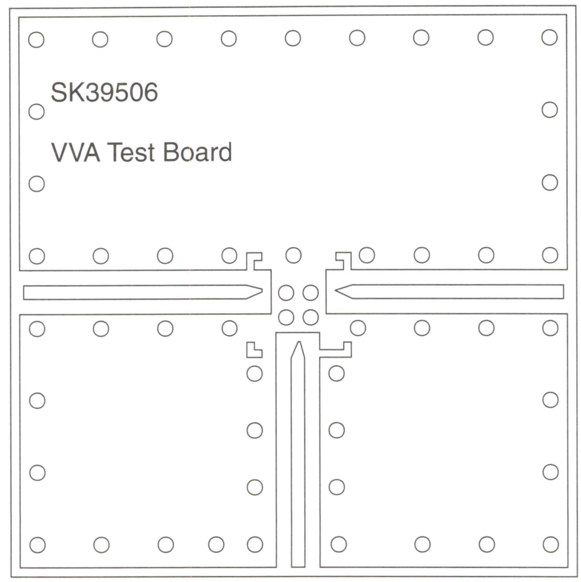


Input IP3 vs. Frequency

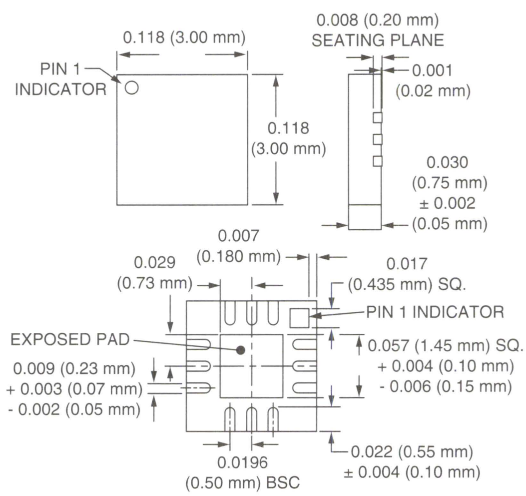


Phase vs. Voltage

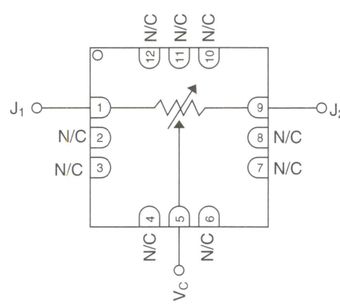
Evaluation Board Layout



QFN-12



Pin Out



Ground is connected to paddle on bottom.

Typical S-Parameters (Control Voltage 0/+1.2 V)

Insertion Loss State # GHZ S MA R 50									High Attenuation State # GHZ S MA R 50							
Freq. (GHz)	S_{11}	S_{11a}	S_{21}	S_{21a}	S_{12}	S_{12a}	S_{22}	S_{22a}	S_{11}	S_{11a}	S_{21}	S_{21a}	S_{12}	S_{12a}	S_{22}	S_{22a}
2.5	0.330	66.05	0.887	-135.38	0.913	-135.67	0.312	45.02	0.160	5.13	0.074	126.57	0.074	126.20	0.161	-18.79
3.0	0.242	18.19	0.914	-175.58	0.946	-175.25	0.210	-22.04	0.129	-40.89	0.021	46.26	0.021	46.12	0.172	-71.10
3.5	0.165	-33.76	0.913	144.77	0.951	144.79	0.145	-94.37	0.152	-97.28	0.026	-107.80	0.026	-107.54	0.209	-118.44
4.0	0.070	-68.30	0.916	103.60	0.959	103.52	0.080	-152.16	0.134	-151.61	0.046	-178.59	0.047	-179.41	0.224	-161.45

Measured S-Parameters include the evaluation board.

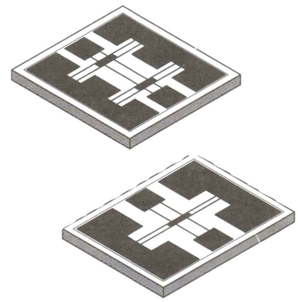
Fixed Attenuator Pads

SKYWORKS

ATN3580 Series

Features

- Specified Flat Response to 40 GHz
- Return Loss > 16 dB to 40 GHz
- Available at 1–10, 12, 15, 20, 30 and 40 dB
- Power Handling to 1 W CW
- Rugged Thin Film Silicon Chips



Description

The ATN3580 series of attenuator chips incorporate thin film resistors on high resistivity silicon chips to achieve precision attenuation, tight flatness and high return loss to 40 GHz. The design uses a balanced TEE resistive structure to assure broad bandwidth performance. The thin film technology offers improved power handling capability in comparison to the traditional thick film printed attenuator. All ATN3580 attenuator chips are specified for their attenuation at DC. In addition, a wafer probe sample test is performed to 40 GHz to assure meeting the flatness specification. Skyworks' measurements indicate that attenuation typically increases with increasing frequency, as shown in Figure 1.

Absolute Maximum Ratings

Characteristic	Value
Incident Power @ 25°C	1 W
Operating Temperature	-55°C to +175°C
Storage Temperature	-65°C to +200°C

Electrical Specifications at 25°C

Nominal Attenuation (dB)	Attenuation Tolerance @ DC (dB)	Attenuation Flatness			Outline Drawing	Part Number
		DC–12 GHz (dB)	DC–26.5 GHz (dB)	DC–40 GHz (dB)		
1	± 0.15	± 0.20	± 0.50	± 1.00	516-060	♦ ATN3580-01
2	± 0.15	± 0.20	± 0.50	± 1.00	516-060	♦ ATN3580-02
3	± 0.25	± 0.20	± 0.50	± 1.00	516-060	♦ ATN3580-03
4	± 0.25	± 0.20	± 0.50	± 1.00	516-060	ATN3580-04
5	± 0.25	± 0.20	± 0.50	± 1.00	516-060	♦ ATN3580-05
6	± 0.25	± 0.40	± 0.60	± 1.00	518-060	ATN3580-06
7	± 0.25	± 0.40	± 0.60	± 1.00	518-060	ATN3580-07
8	± 0.35	± 0.40	± 0.60	± 1.00	518-060	ATN3580-08
9	± 0.35	± 0.40	± 0.60	± 1.00	518-060	ATN3580-09
10	± 0.35	± 0.40	± 0.60	± 1.00	518-060	♦ ATN3580-10
12	± 0.50	± 0.40	± 0.60	± 1.00	518-060	ATN3580-12
15	± 0.50	± 0.40	± 0.60	± 1.00	518-060	ATN3580-15
20	± 1.10	± 1.00	± 2.00	± 4.00	518-060	ATN3580-20
30	± 1.60	± 1.00	± 2.00	± 4.00	518-060	ATN3580-30
40	± 1.60	± 1.00	± 2.00	± 4.00	518-060	ATN3580-40

♦ Available through distribution.

Return Loss	DC–7 GHz (dB) Min.	DC–12 GHz (dB) Min.	DC–26.5 GHz (dB) Min.	DC–40 GHz (dB) Min.
ATN3580 Series	22	20	18	16

Typical Performance Data

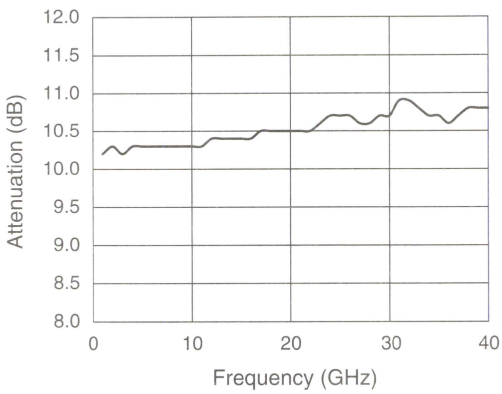


Figure 1. ATN3580-10 Attenuation vs. Frequency

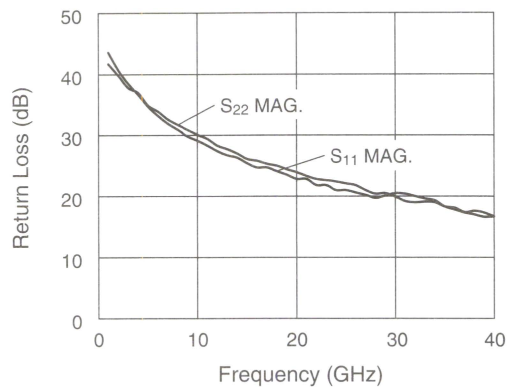
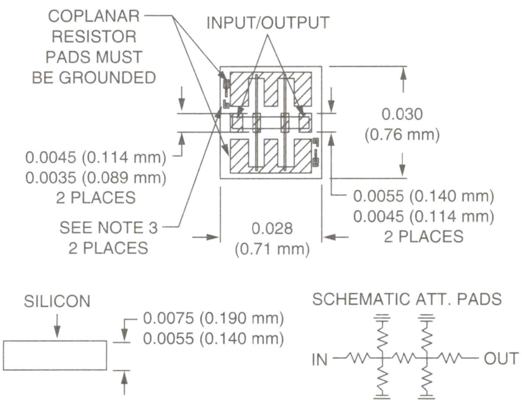


Figure 2. ATN3580-10 Return Loss vs. Frequency

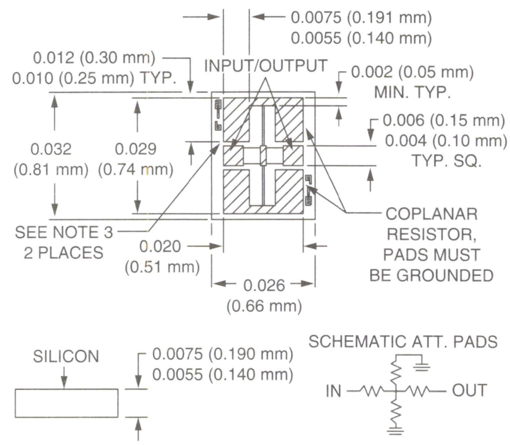
Outline Drawings

518-060



1. Cross hatching = gold contact areas.
2. Dimensions not specified in this drawing vary per attenuation value.
3. Indicates attenuation value.
4. This DIM. can be as high 0.012 for high attenuation values.
5. Back surface is gold, grounding not required.

516-060



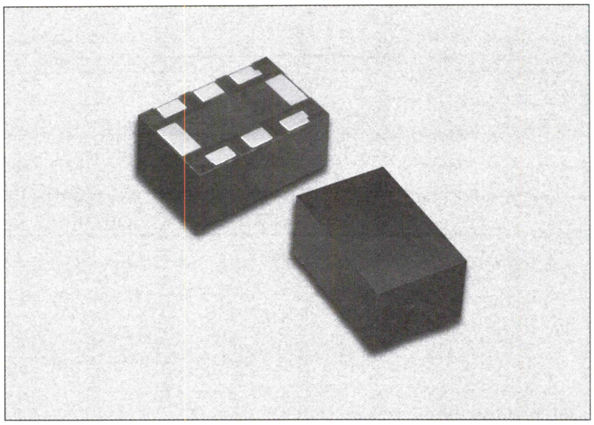
1. Cross hatching = gold contact areas.
2. Dimensions not specified in this drawing vary per attenuation value.
3. Indicates attenuation value.
4. Back surface is gold, grounding not required.

Phase Shifters

LGA Packaged Phase Shifter for AMPS Base Stations

SKYWORKS

PS088-315



Features

- Designed for AMPS 881.5 ± 12.5 MHz Band
- 100 Degree Phase Shift Range
- 1.5 Degree Phase Deviation
- 0.3 dB Insertion Loss Deviation
- 0–12 V Control Voltage Range
- Specified 33 dBm IP3
- Small Footprint LGA Package

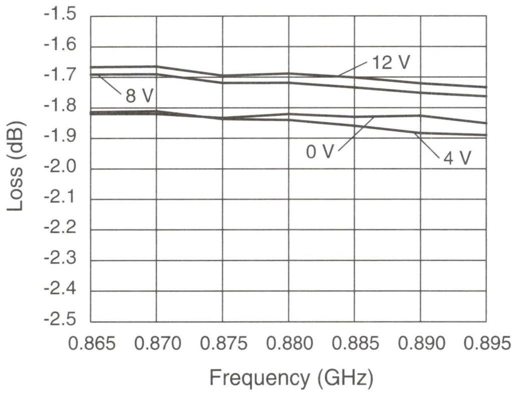
Description

The PS088-315 is a voltage controlled phase shifter designed for use in power amplifier distortion compensation circuits in AMPS band base station applications. Its characteristics are specified in a 25 MHz bandwidth centered at 881.5 MHz. The PS088-315 employs a monolithic quadrature hybrid and a pair of selected silicon varactor diodes to achieve 100 degree phase shift and low insertion loss. The PS088-315 is packaged in the small outline LGA (Land Grid Array) surface mount package with the internal elements affixed to an organic BT substrate.

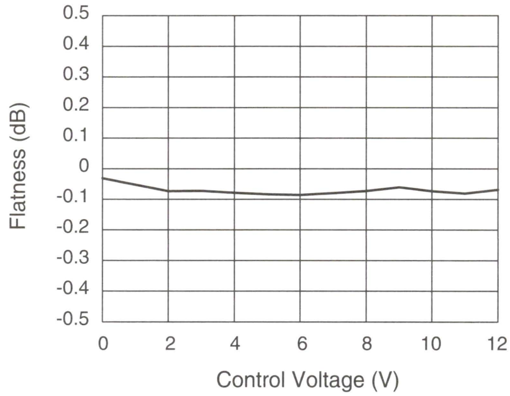
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range (BW)	F_O = 881.5	869		894	MHz
Phase Shift	At F_O, C_V = 12 V from C_V = 0 V	100			Deg.
Phase Deviation in BW	C_V = 0–12 V		1.5	2.0	Deg.
Control Voltage (C_V) Range		0		12	V
Control Current	C_V = 12 V			1	µA
Insertion Loss in BW	C_V = 0 V			2.3	dB
I.L. Flatness in BW	C_V = 0–12 V			0.3	dB
I.L. Variation	At F_O, C_V = 0–12 V			0.75	dB
VSWR in BW				1.8	
IM3	P_{IN} = 8 dBm, 900/905 MHz, C_V = 0 V			-50	dBc
IP3	Derived from IM3	33			dBm

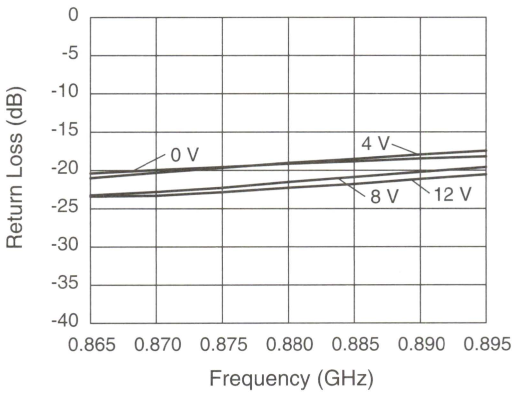
Typical Performance Data



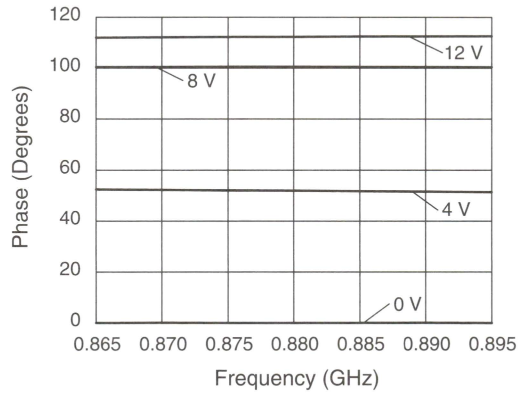
Insertion Loss vs. Frequency and Control Voltage



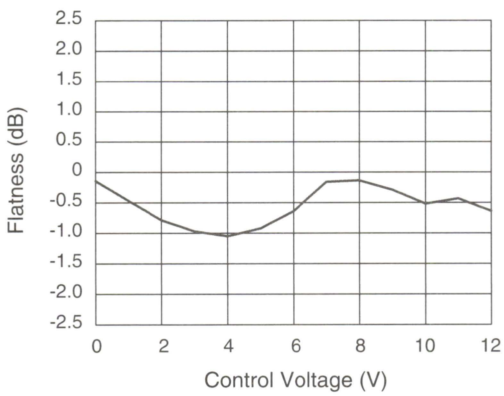
Insertion Loss Flatness vs. Control Voltage



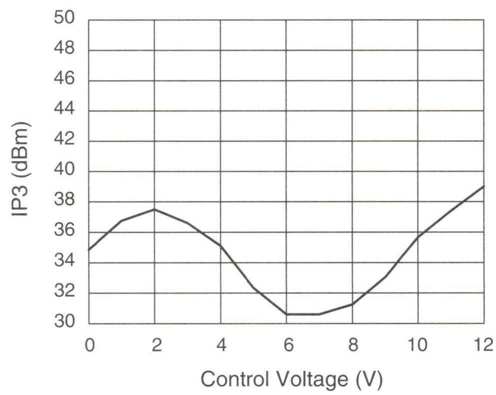
Input/Output Return Loss vs. Frequency and Control Voltage



Phase vs. Frequency and Control Voltage

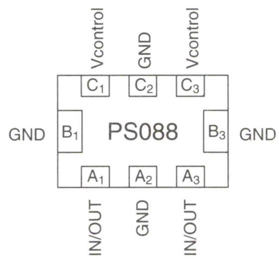


Phase Flatness vs. Control Voltage



IP3 vs. Control Voltage
RF_1 = 0.900 GHz, RF_2 = 0.905 GHz @ 8 dBm

Pin Out (Bottom View)

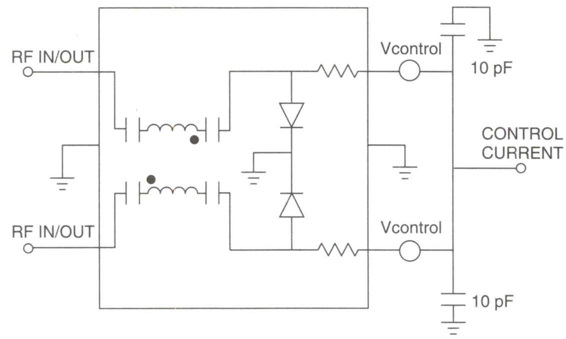


Terminal No.	Terminal Name
A_1 (Pin 1)	IN/OUT
A_2	GND
A_3	IN/OUT
B_1	GND
B_3	GND
C_1	Vcontrol
C_2	GND
C_3	Vcontrol

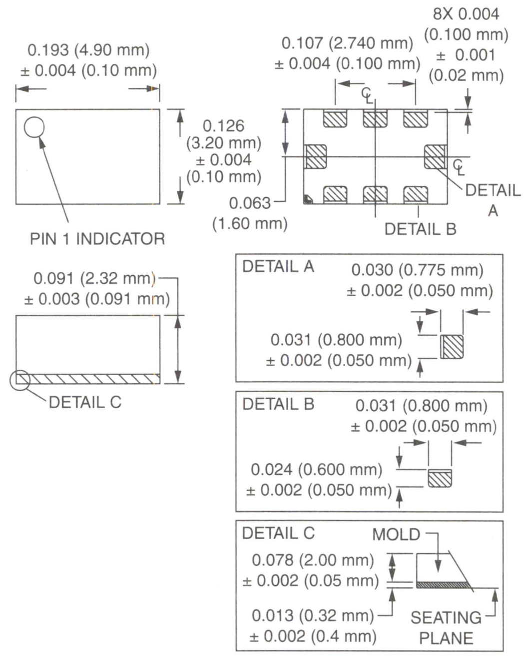
Absolute Maximum Ratings

Characteristic	Value
RF Input Power	20 dBm
Control Voltage	15 V
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +85°C
Electrostatic Discharge	HBM 1 B

Connection Diagram



-315



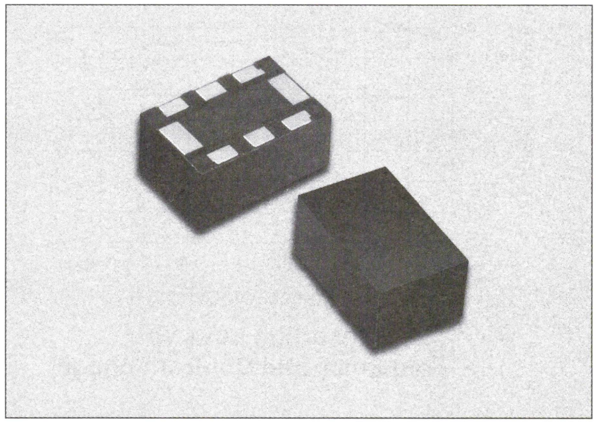
LGA Packaged Phase Shifter for GSM Base Stations

SKYWORKS

PS094-315

Features

- Designed for GSM 942.5 ± 17.5 MHz Band
- 100 Degree Phase Shift Range
- 1.5 Degree Phase Deviation
- 0.3 dB Insertion Loss Deviation
- 0–12 V Control Voltage Range
- Specified 33 dBm IP3
- Small Footprint LGA Package



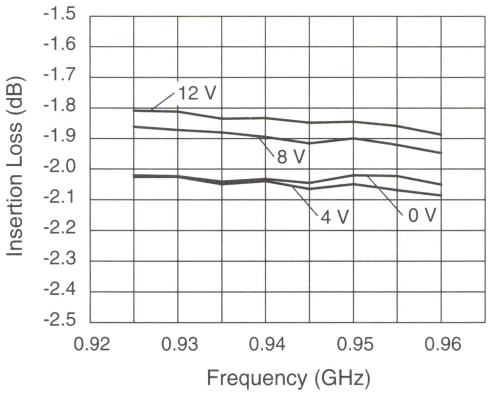
Description

The PS094-315 is a voltage controlled phase shifter specifically designed for use in power amplifier distortion compensation circuits centered at 942.5 MHz in GSM band base stations. Its characteristics are specified in a 35 MHz bandwidth. The PS094-315 employs a monolithic quadrature hybrid and a pair of selected silicon varactor diodes to achieve 100 degree phase shift and low insertion loss. The PS094-315 is packaged in the small outline LGA (Land Grid Array) surface mount package with the internal elements affixed to an organic BT substrate.

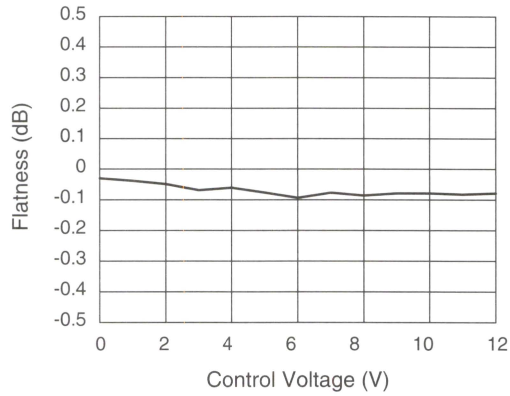
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range (BW)	$F_O = 942.5$	925		960	MHz
Phase Shift	At F_O, C_V = 12 V	100			Deg.
Phase Deviation in BW	C_V = 0–12 V		1.5	2.0	Deg.
Control Voltage (C_V) Range		0		12	V
Control Current	C_V = 12 V			1	µA
Insertion Loss in BW	C_V = 0 V			2.3	dB
I.L. Deviation in BW	C_V = 0–12 V			0.3	dB
I.L. Variation	At F_O, C_V = 0–12 V			0.75	dB
VSWR in BW				1.8	
IM3	P_{IN} = 8 dBm, 900/905 MHz, C_V = 0 V			-50	dBc
IP3	Derived from IM3	33			dBm

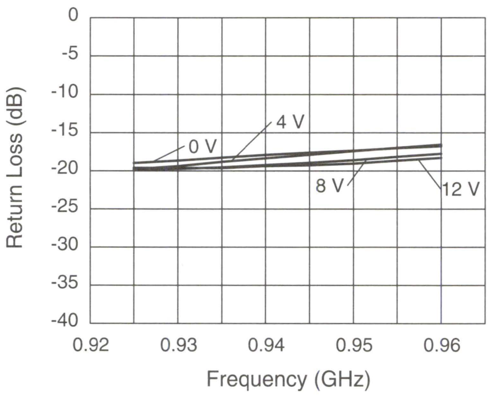
Typical Performance Data



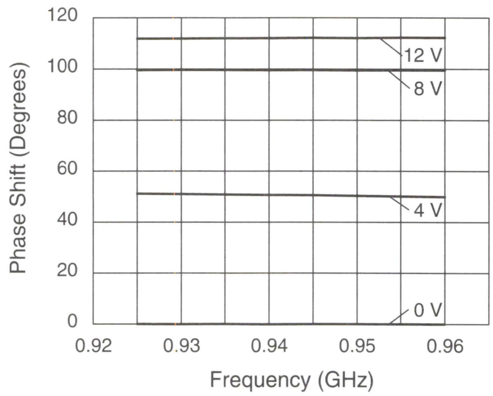
Insertion Loss vs. Frequency and Control Voltage



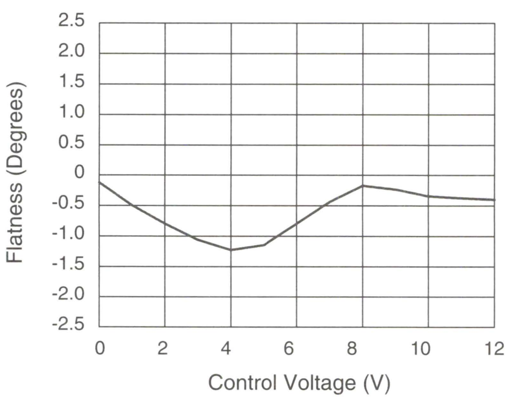
Insertion Loss Flatness vs. Control Voltage



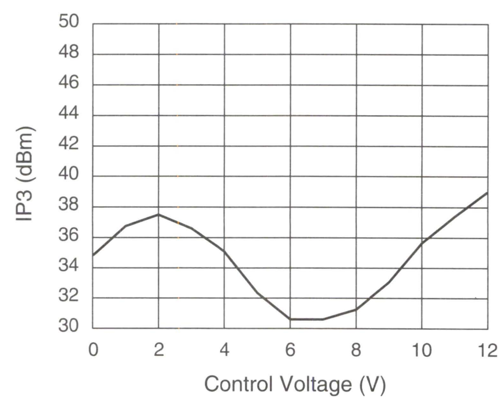
Input/Output Return Loss vs. Frequency and Control Voltage



Phase vs. Frequency and Control Voltage

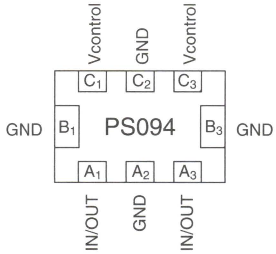


Phase Flatness vs. Control Voltage



IP3 vs. Control Voltage
RF_1 = 0.900 GHz, RF_2 = 0.905 GHz @ 8 dBm

Pin Out (Bottom View)

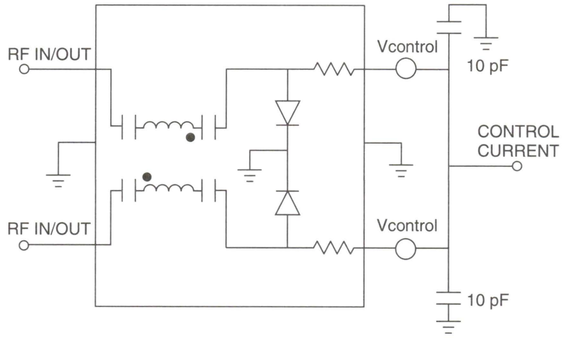


Terminal No.	Terminal Name
A_1 (Pin 1)	IN/OUT
A_2	GND
A_3	IN/OUT
B_1	GND
B_3	GND
C_1	Vcontrol
C_2	GND
C_3	Vcontrol

Absolute Maximum Ratings

Characteristic	Value
RF Input Power	20 dBm
Control Voltage	15 V
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +85°C
Electrostatic Discharge	HBM 1 B

Connection Diagram



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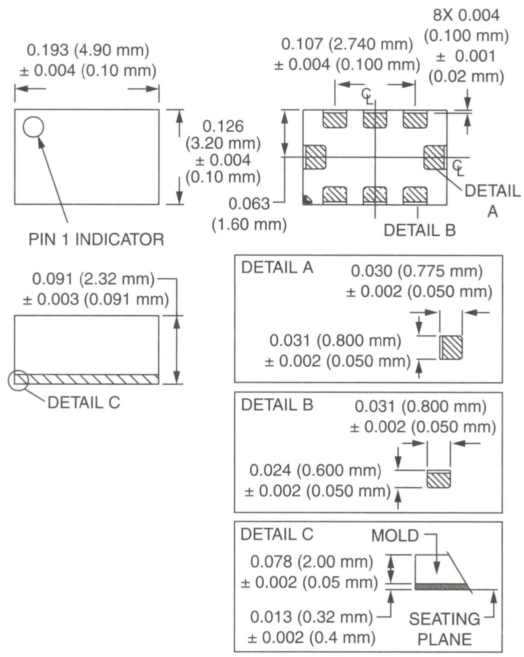


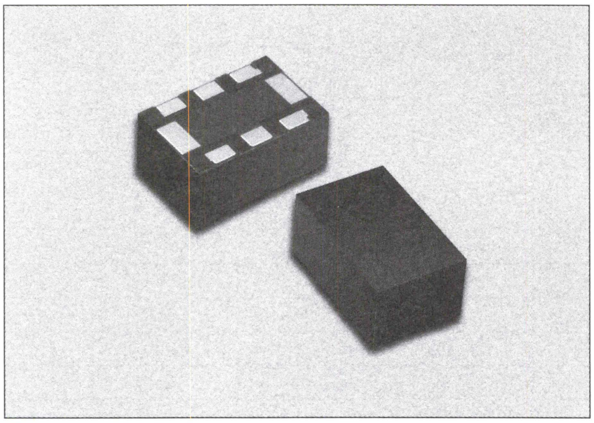
LGA Packaged Phase Shifter for DCS Base Stations

SKYWORKS

PS184-315

Features

- Designed for DCS 1837.5 ± 32.5 MHz Band
- 100 Degree Phase Shift Range
- 1.5 Degree Phase Deviation
- 0.3 dB Insertion Loss Deviation
- 0–12 V Control Voltage Range
- Specified 33 dBm IP3
- Small Footprint LGA Package



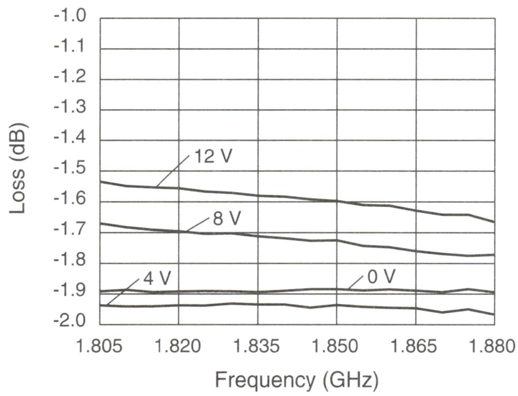
Description

The PS184-315 is a voltage controlled phase shifter specifically designed for use in power amplifier distortion compensation circuits centered at 1837.5 MHz in DCS band base stations. Its characteristics are specified in a 70 MHz bandwidth. The PS184-315 employs a monolithic quadrature hybrid and a pair of selected silicon varactor diodes to achieve 100 degree phase shift and low insertion loss. The PS184-315 is packaged in the small outline LGA (Land Grid Array) surface mount package with the internal elements affixed to an organic BT substrate.

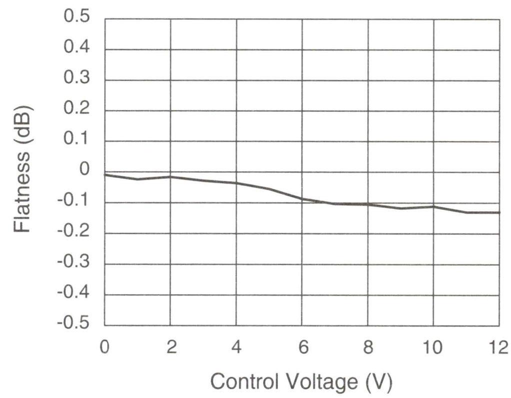
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range (BW)	$F_{O} =$ 1837.5	1805		1870	MHz
Phase Shift	At F_O, C_V = 12 V	100			Deg.
Phase Deviation in BW	C_V = 0–12 V		1.5	2.0	Deg.
Control Voltage (C_V) Range		0		12	V
Control Current	C_V = 12 V			1	µA
Insertion Loss in BW	C_V = 0 V			2.3	dB
I.L. Deviation in BW	C_V = 0–12 V			0.3	dB
I.L. Variation	At F_O, C_V = 0–12 V			0.75	dB
VSWR in BW				1.8	
IM3	P_{IN} = 8 dBm, 1900/1905 MHz, C_V = 0 V			-50	dBc
IP3	Derived from IM3	33			dBm

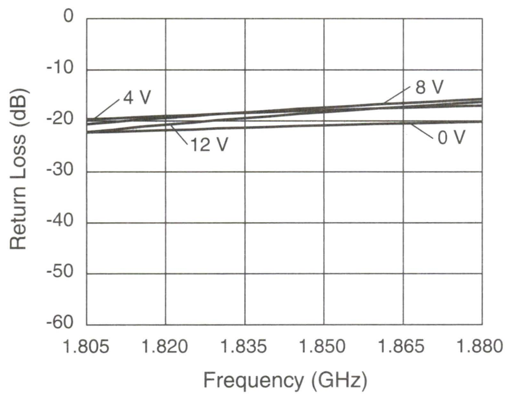
Typical Performance Data



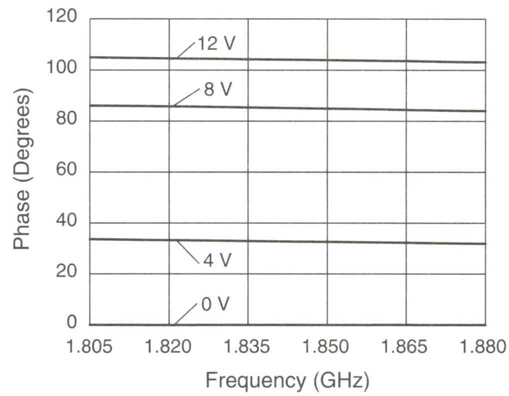
Insertion Loss vs. Frequency and Control Voltage



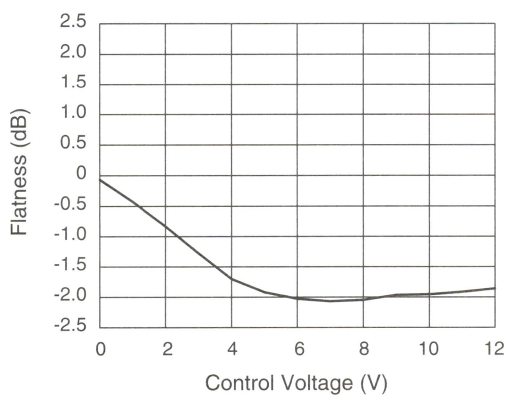
Insertion Loss Flatness vs. Control Voltage



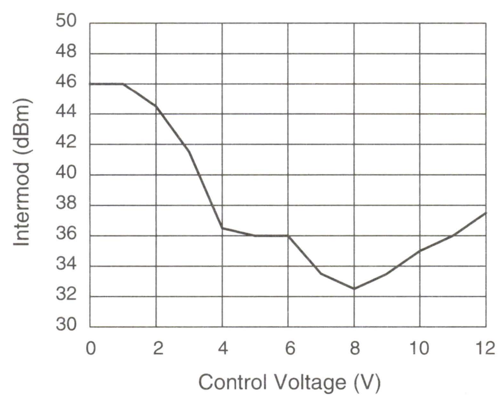
Input/Output Return Loss vs. Frequency and Control Voltage



Phase vs. Frequency and Control Voltage

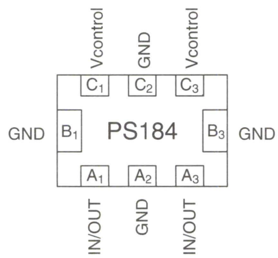


Phase Flatness vs. Control Voltage



3rd Order Intermod vs. Control Voltage
RF_1 = 1.900 GHz, RF_2 = 1.905 GHz @ 8 dBm

Pin Out (Bottom View)

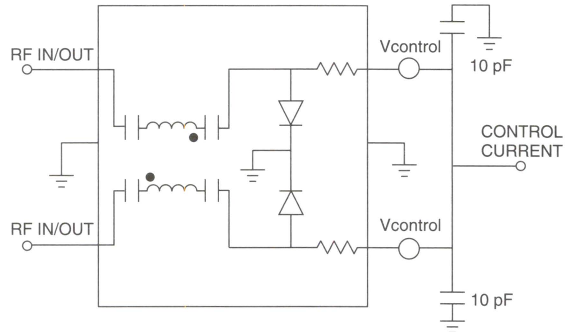


Terminal No.	Terminal Name
A_1 (Pin 1)	IN/OUT
A_2	GND
A_3	IN/OUT
B_1	GND
B_3	GND
C_1	Vcontrol
C_2	GND
C_3	Vcontrol

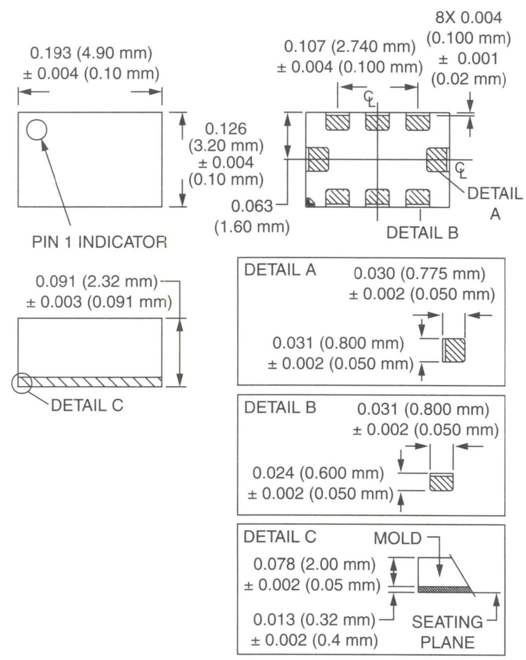
Absolute Maximum Ratings

Characteristic	Value
RF Input Power	20 dBm
Control Voltage	15 V
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +85°C
Electrostatic Discharge	HBM 1 B

Connection Diagram



-315

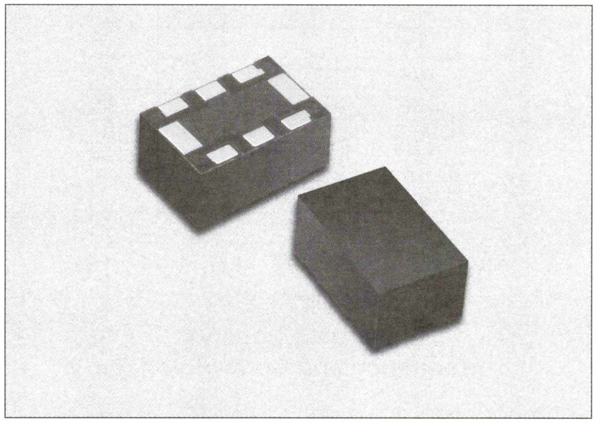


Preliminary

LGA Packaged Phase Shifter for PCS Base Stations

SKYWORKS

PS196-315



Features

- Designed for PCS 1960 ± 30 MHz Band
- 100 Degree Phase Shift Range
- 1.5 Degree Phase Deviation
- 0.3 dB Insertion Loss Deviation
- 0–12 V Control Voltage Range
- Specified 33 dBm IP3
- Small Footprint LGA Package

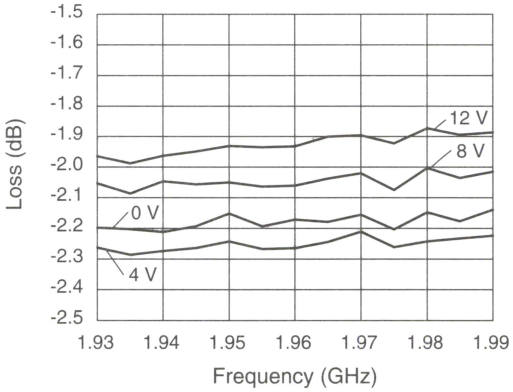
Description

The PS196-315 is a voltage controlled phase shifter specifically designed for use in power amplifier distortion compensation circuits centered at 1960 MHz in PCS band base stations. Its characteristics are specified in a 60 MHz bandwidth. The PS196-315 employs a monolithic quadrature hybrid and a pair of selected silicon varactor diodes to achieve 100 degree phase shift and low insertion loss. The PS196-315 is packaged in the small outline LGA (Land Grid Array) surface mount package with the internal elements affixed to an organic BT substrate.

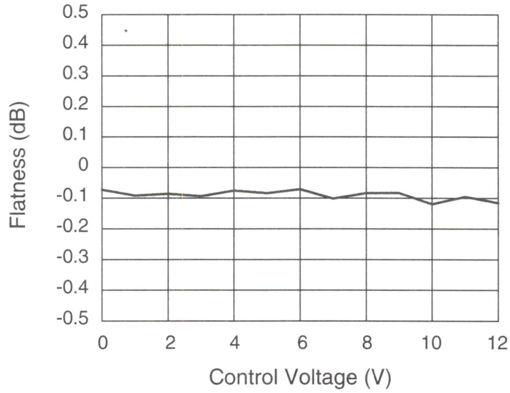
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range (BW)	F_O = 1946	1916		1976	MHz
Phase Shift	At F_O, C_V = 12 V	100			Deg.
Phase Deviation in BW	C_V = 0–12 V		1.5	2.0	Deg.
Control Voltage (C_V) Range		0		12	V
Control Current	C_V = 12 V			1	µA
Insertion Loss in BW	(C_V = 0 V)			2.3	dB
I.L. Deviation in BW	C_V = 0–12 V			0.3	dB
I.L. Variation	At F_O, C_V = 0–12 V			0.75	dB
VSWR in BW				1.8	
IM3	P_{IN} = 8 dBm, 1900/1905 MHz, C_V = 0 V			-50	dBc
IP3	Derived from IM3	33			dBm

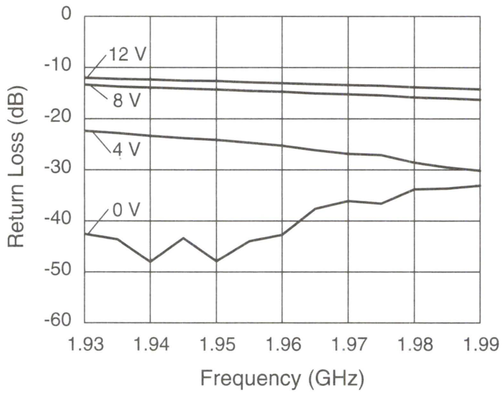
Typical Performance Data



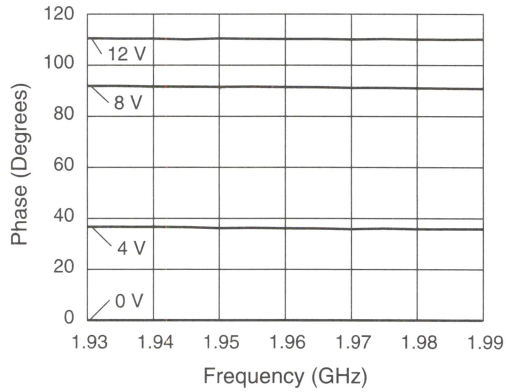
Insertion Loss vs. Frequency and Control Voltage



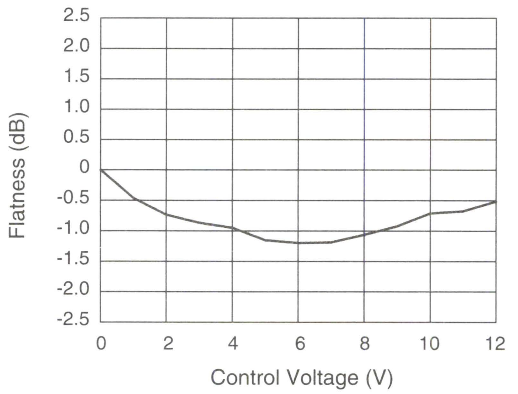
Insertion Loss Flatness vs. Control Voltage



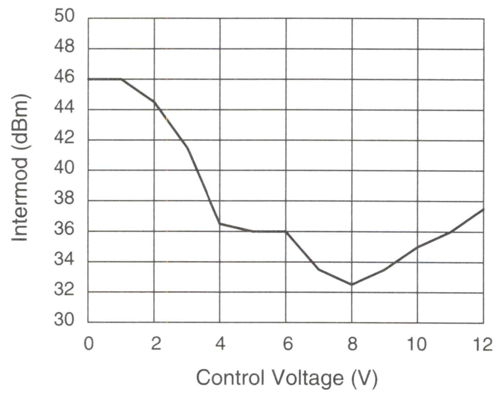
Input/Output Return Loss vs. Frequency and Control Voltage



Phase vs. Frequency and Control Voltage

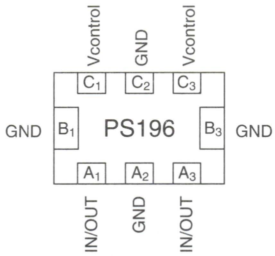


Phase Flatness vs. Control Voltage



3rd Order Intermod vs. Control Voltage
RF_1 = 1.900 GHz, RF_2 = 1.905 GHz @ 8 dBm

Pin Out (Bottom View)

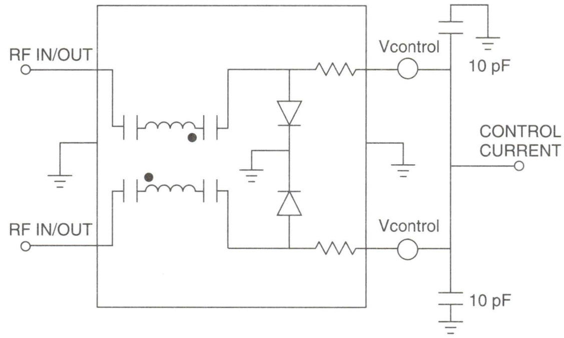


Terminal No.	Terminal Name
A_1 (Pin 1)	IN/OUT
A_2	GND
A_3	IN/OUT
B_1	GND
B_3	GND
C_1	Vcontrol
C_2	GND
C_3	Vcontrol

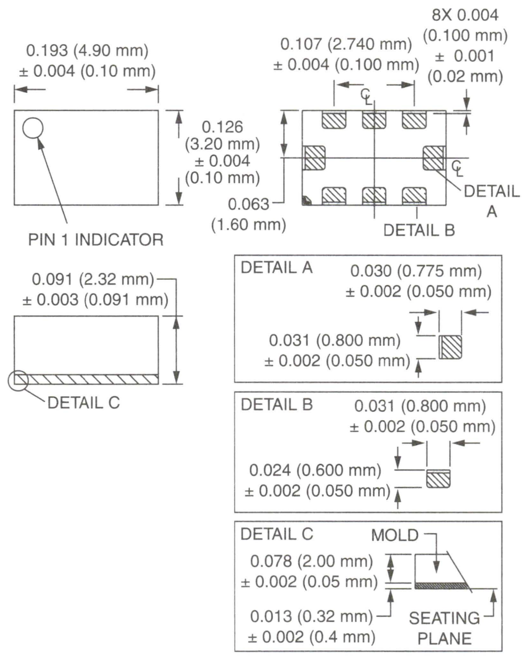
Absolute Maximum Ratings

Characteristic	Value
RF Input Power	20 dBm
Control Voltage	15 V
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +85°C
Electrostatic Discharge	HBM 1 B

Connection Diagram



-315



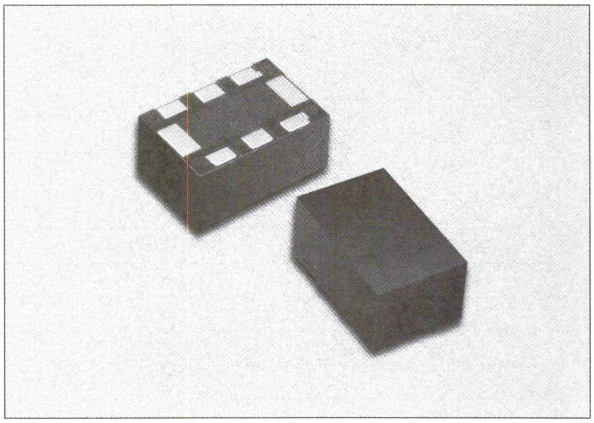
LGA Packaged Phase Shifter for UMTS Base Stations

SKYWORKS

PS214-315

Features

- Designed for UMTS 2140 ± 30 MHz Band
- 100 Degree Phase Shift Range
- 1.5 Degree Phase Deviation
- 0.3 dB Insertion Loss Deviation
- 0–12 V Control Voltage Range
- Specified 33 dBm IP3
- Small Footprint LGA Package



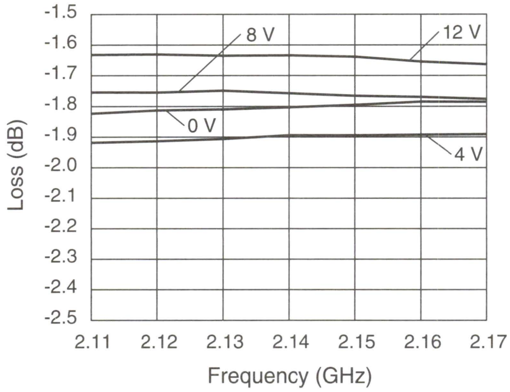
Description

The PS214-315 is a voltage controlled phase shifter specifically designed for use in power amplifier distortion compensation circuits centered at 2140 MHz in UMTS band base stations. Its characteristics are specified in a 60 MHz bandwidth. The PS214-315 employs a monolithic quadrature hybrid and a pair of selected silicon varactor diodes to achieve 100 degree phase shift and low insertion loss. The PS214-315 is packaged in the small outline LGA (Land Grid Array) surface mount package with the internal elements affixed to an organic BT substrate.

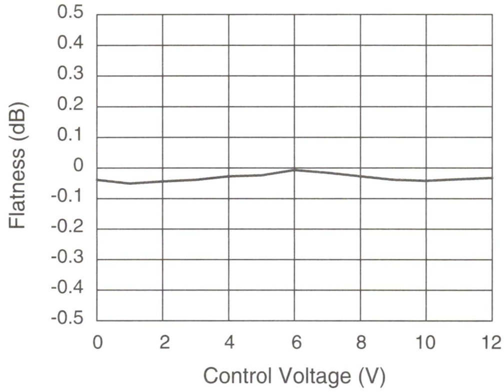
Electrical Specifications at 25°C

Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range (BW)	F_O = 2140	2110		2170	MHz
Phase Shift	At F_O, C_V = 12 V	100			Deg.
Phase Deviation in BW	C_V = 0–12 V		1.5	2.0	Deg.
Control Voltage (C_V) Range		0		12	V
Control Current	C_V = 12 V			1	µA
Insertion Loss in BW	C_V = 0 V			2.3	dB
I.L. Deviation in BW	C_V = 0–12 V			0.3	dB
I.L. Variation	At F_O, C_V = 0–12 V			0.7	dB
VSWR in BW				1.8	
IM3	P_{IN} = 8 dBm, 2140/2145 MHz, C_V = 0 V			-50	dBc
IP3	Derived from IM3	33			dBm

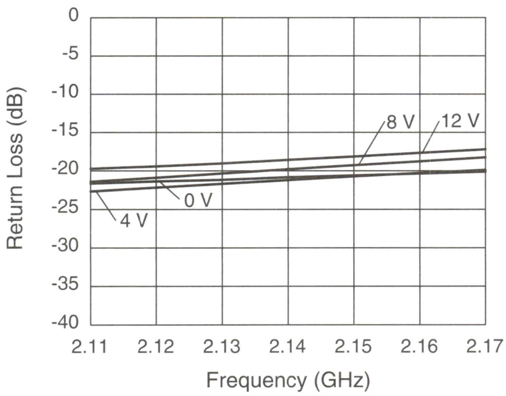
Typical Performance Data



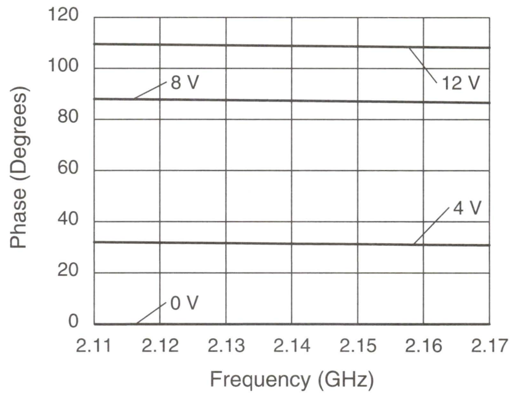
Insertion Loss vs. Frequency and Control Voltage



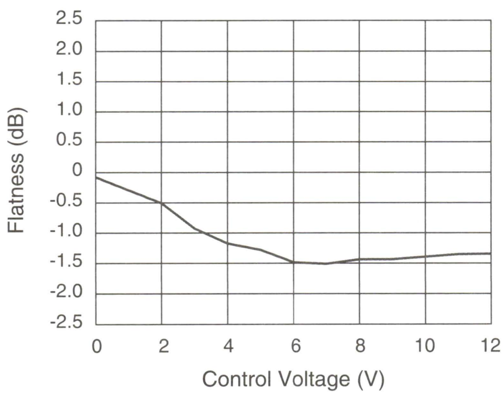
Insertion Loss Flatness vs. Control Voltage



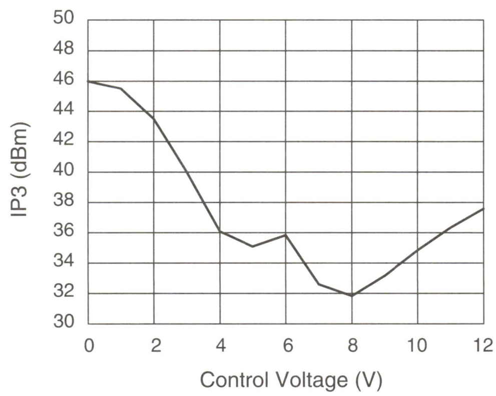
Input/Output Return Loss vs. Frequency and Control Voltage



Phase vs. Frequency and Control Voltage

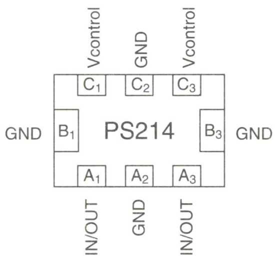


Phase Flatness vs. Control Voltage



IP3 vs. Control Voltage
RF_1 = 2.140 GHz, RF_2 = 2.145 GHz @ 8 dBm

Pin Out (Bottom View)

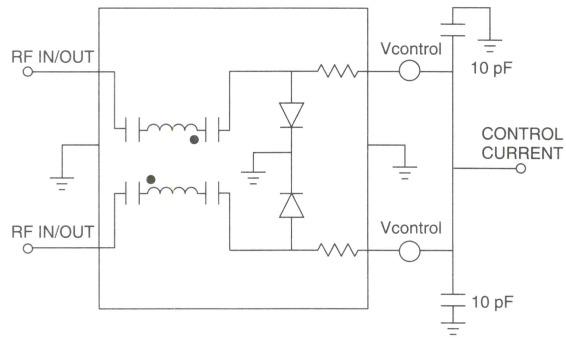


Terminal No.	Terminal Name
A_1 (Pin 1)	IN/OUT
A_2	GND
A_3	IN/OUT
B_1	GND
B_3	GND
C_1	Vcontrol
C_2	GND
C_3	Vcontrol

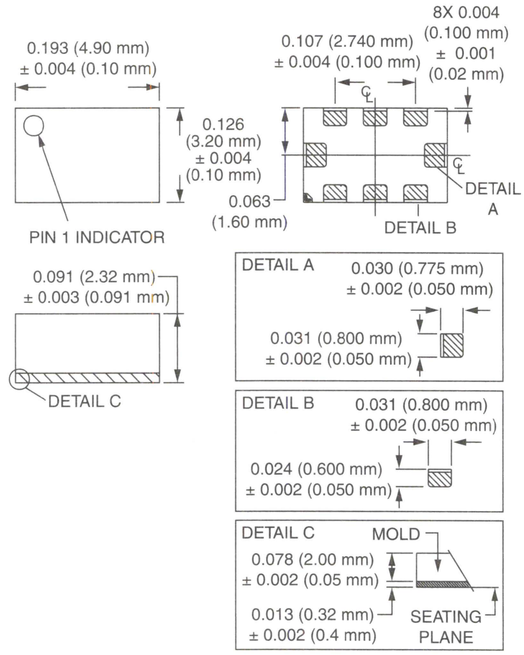
Absolute Maximum Ratings

Characteristic	Value
RF Input Power	20 dBm
Control Voltage	15 V
Operating Temperature	-40 to +85°C
Storage Temperature	-40 to +85°C
Electrostatic Discharge	HBM 1 B

Connection Diagram



-315



Reference Material

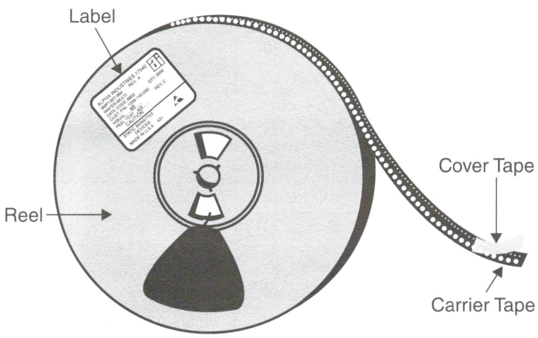
Discrete Semiconductors and Microwave Components Application Notes

SKYWORKS

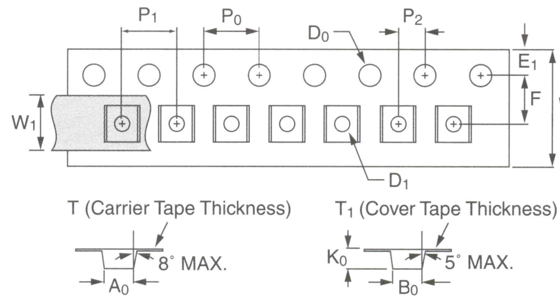
To access the Application Notes listed here, please visit the Skyworks website at www.skyworksinc.com

Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation

SKYWORKS



Tape Dimensions



Description	Sym.	Chip Scale	SC-79	SOD-323	SC-70	SC-88	SOT-23	SOT-143	SOT-5 Lead
Cavity									
Length	A_0	0.65±0.05	0.90±0.05	1.45±0.10	2.25±0.10	2.25±0.10	3.15±0.10	3.099±0.10	3.15±0.10
Width	B_0	0.76±0.05	1.40±0.05	3.20±0.10	2.70±0.10	2.70±0.10	3.20±0.10	2.692±0.10	3.20±0.10
Depth	K_0	0.53±0.05	0.73±0.05	1.35±0.10	0.53±0.05	1.19±0.10	1.40±0.10	1.295±0.10	1.40±0.10
Pitch	P_1	2.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00± 0.10
Bottom Hole Diameter	D_1	N/A	0.50±0.05	1.00±0.10	0.50±0.05	1.00±0.10	1.00±0.10	1.00±0.10	1.00±0.10
Perforation									
Diameter	D_0	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10	1.55±0.05	1.50±0.10	1.50±0.10
Pitch	P_0	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
Position	E_1	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10
Carrier Tape									
Width	W	8.00±0.20	8.00±0.20	8.00±0.20	8.00±0.10	8.00±0.30	8.00±0.30	8.00±0.10	8.00±0.30
Thickness	T	0.43±0.05	0.180±0.02	0.254±0.013	0.30±0.05	0.254±0.013	0.254±0.013	0.254±0.013	0.20±0.03
Cover Tape									
Width	W_1	5.40±0.10	5.40±0.10	5.40±0.10	5.40±0.10	5.40±0.10	5.40±0.10	5.40±0.10	5.40±0.10
Tape Thickness	T_1	0.062±0.01	0.062±0.01	0.062±0.01	0.062±0.01	0.062±0.01	0.062±0.01	0.062±0.01	0.062±0.01
Distance									
Cavity to Perforation (Width Direction)	F	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05
Cavity to Perforation (Length Direction)	P_2	1.00±0.025	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05

Note: All dimensions are in mm.

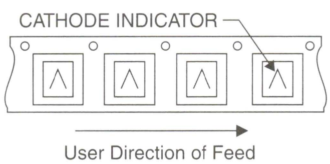
Description	Sym.	SOT-6 Lead	SOIC-8	MSOP-8	PLCC-28	QFN 2 X 3	QFN 3 x 3	QFN 4 x 4	QFN 5 x 5
Cavity									
Length	A_0	3.15±0.10	6.70±0.10	5.20±0.10	13.0±0.10	2.20±0.10	3.30±0.10	4.35±0.10	5.25±0.10
Width	B_0	3.20±0.10	5.40±0.10	3.30±0.10	13.0±0.10	3.20±0.10	3.30±0.10	4.35±0.10	5.25±0.10
Depth	K_0	1.40±0.10	2.00±0.10	1.60±0.10	4.90±0.10	1.10±0.10	1.10±0.10	1.10±0.10	1.10±0.10
Pitch	P_1	4.00±0.10	8.15±0.02	8.00±0.10	12.0±0.10	4.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10
Bottom Hole Diameter	D_1	1.00±0.10	1.60±0.02	1.00±0.10	1.60±0.02	1.50±0.10	1.00±0.10	1.00±0.10	1.00±0.10
Perforation									
Diameter	D_0	1.50±0.10	1.60±0.03	1.50±0.10	1.60±0.03	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10
Pitch	P_0	4.00±0.10	3.75±0.02	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
Position	E_1	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10
Carrier Tape									
Width	W	8.00±0.30	12.00±0.30	12.00±0.30	24.00±0.30	12.00±0.30	12.00±0.30	12.00±0.30	12.00±0.30
Thickness	T	0.20±0.03	0.30±0.05	0.30±0.013	0.30±0.005	0.30±0.05	0.30±0.05	0.30±0.05	0.30±0.05
Cover Tape									
Width	W_1	5.40±0.10	9.20±0.10	9.20±.010		9.20±0.01	9.20±0.10	9.20±0.10	9.20±0.10
Tape Thickness	T_1	0.062±0.01	0.062±0.01	0.062±0.01	0.062±0.01	0.051±0.01	0.051±0.01	0.051±0.01	0.051±0.01
Distance									
Cavity to Perforation (Width Direction)	F	3.50±0.05	3.50±0.05	5.60±0.05		5.50±0.05	5.50±0.10	5.50±0.10	5.50±0.10
Cavity to Perforation (Length Direction)	P_2	2.00±0.05	2.00±0.05	4.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05

Note: All dimensions are in mm.

Description	Sym.	TSSOP-16	SOIC-14	SOIC-16	SSOP-16	SSOP-20	LGA-6	LGA-16
Cavity								
Length	A_0	6.80±0.10	6.50±0.10	6.50±0.10	6.70±0.10	8.20±0.10	1.40±0.10	8.40±0.10
Width	B_0	5.40±0.10	9.00±0.10	10.30±0.10	5.40±0.10	7.60±0.10	1.70±0.10	10.70±0.10
Depth	K_0	1.60±0.10	2.10±0.10	2.10±0.10	2.10±0.10	3.00±0.10	1.00±0.10	2.40±0.10
Pitch	P_1	8.00±0.10	8.00±0.10	8.00±0.10	8.15±0.02	12.00±0.10	4.00±0.10	16.00±0.10
Bottom Hole Diameter	D_1	1.60±0.10	1.60±0.10	1.60±0.10	1.60±0.02	1.60±0.10	1.00±0.10	1.60±0.20
Perforation								
Diameter	D_0	1.50±0.10	1.55±0.10	1.55±0.10	1.60±0.03	1.50±0.10	1.50±0.10	1.60±0.03
Pitch	P_0	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
Position	E_1	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10		1.75±0.10	1.75±0.10
Carrier Tape								
Width	W	12.0±0.30	16.00±0.30	16.00±0.30	12.0±0.30	16.00±0.30	8.00±0.30	16.00±0.30
Thickness	T	0.30±0.05	0.30±0.05	0.30±0.05	0.30±0.05	0.30±0.05	0.30±0.05	0.30±0.005
Cover Tape								
Width	W_1	9.20±0.10	13.30±0.10	13.30±0.10	9.20±0.10	13.30±0.10	5.40±0.10	13.30±0.10
Tape Thickness	T_1	0.062±0.01	0.062±0.01	0.062±0.01	0.062±0.01	0.062±0.01	0.062±0.10	0.062±0.01
Distance								
Cavity to Perforation (Width Direction)	F	7.50±0.10	7.50±0.10	7.50±0.05	3.50±0.05	7.50±0.05	3.50±0.05	7.50±0.10
Cavity to Perforation (Length Direction)	P_2	2.00±0.1	2.00±0.10	2.00±0.10	2.00±0.05	2.00±0.10	2.00±0.05	2.00±0.10

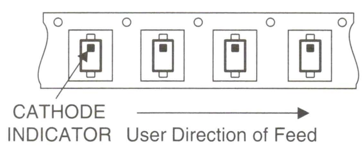
Note: All dimensions are in mm.

Chip Scale



Standard Reel Size	7"
Standard Reel Quantity	N/A

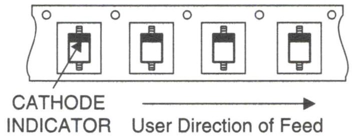
SC-79



Standard Reel Size	7"	13"
Standard Reel Quantity*	3,000	12,000

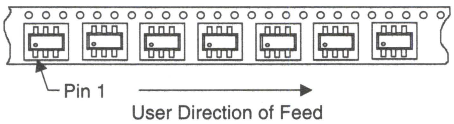
*Available through distribution.

SOD-323



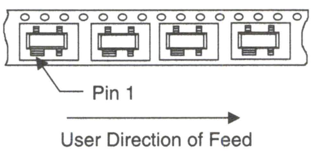
Standard Reel Size	7"	13"
Standard Reel Quantity	3,000	12,000

SOT-6 and SC-88



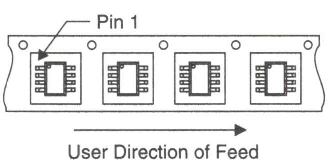
Standard Reel Size	7"	13"
Standard Reel Quantity	3,000	12,000

SOT-143



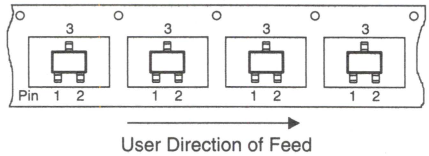
Standard Reel Size	7"	13"
Standard Reel Quantity	3,000	12,000

MSOP-8 and SOIC-8



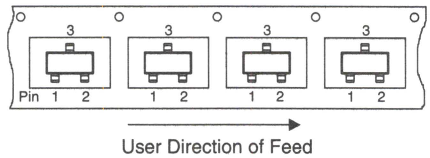
Standard Reel Size	7"	13"
Standard Reel Quantity	1,000	3,000

SC-70



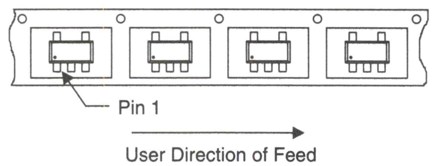
Standard Reel Size	7"	13"
Standard Reel Quantity	3,000	12,000

SOT-23



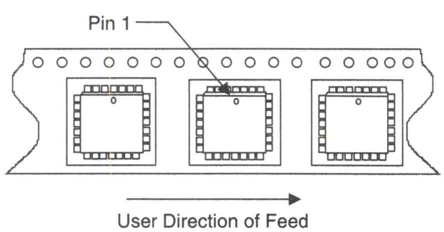
Standard Reel Size	7"	13"
Standard Reel Quantity	3,000	12,000

SOT-5



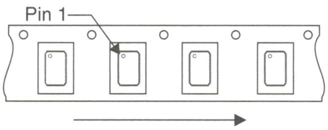
Standard Reel Size	7"	13"
Standard Reel Quantity	3,000	12,000

28 Lead PLCC



Standard Reel Size	7"	13"
Standard Reel Quantity	N/A	1,500

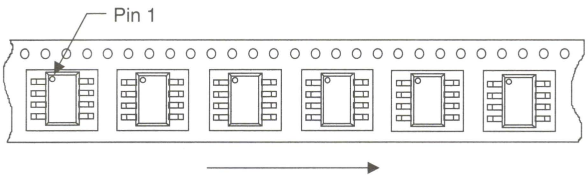
QFN (2 x 3)



Standard Reel Size	7"	13"
Standard Reel Quantity	1,000	3,000

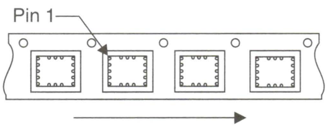
SOIC, MSOP, QSOP, SSOP and TSSOP Devices

8, 10, 14, 16, 20, 28 Leads



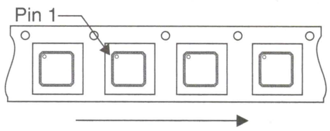
Standard Reel Size	7"	13"
Standard Reel Quantity	1,000	3,000

LGA-16 (-500)



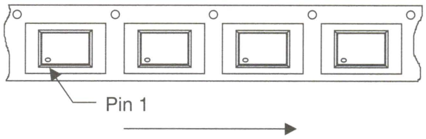
Standard Reel Size	7"	13"
Standard Reel Quantity	1,000	3,000

QFN (3 x 3), (4 x 4) and (5 x 5)



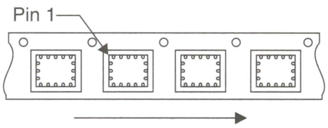
Standard Reel Size	7"	13"
Standard Reel Quantity	1,000	3,000

LGA-6



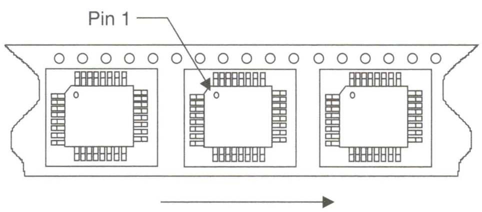
Standard Reel Size	7"	13"
Standard Reel Quantity	3,000	12,000

LGA-16 (-501)



Standard Reel Size	7"	13"
Standard Reel Quantity	1,000	3,000

32 Lead TQFP



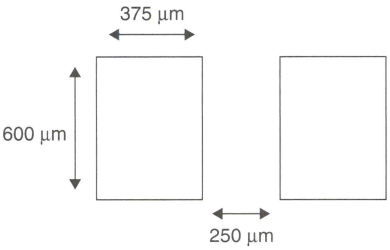
Standard Reel Size	7"	13"
Standard Reel Quantity	N/A	2,000

Suggested PCB Land Pattern Designs for Leaded and Leadless Packages and Detailed Surface Mount Guidelines for Leadless Packages

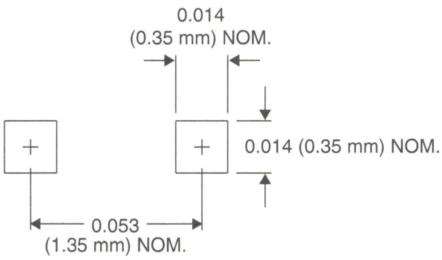
SKYWORKS

Below are sample printed circuit board land pattern dimensions. These are based on the IPC (Institute for Interconnecting and Packaging Electronic Circuits) surface mount design and land pattern standard: IPC-SM-782.

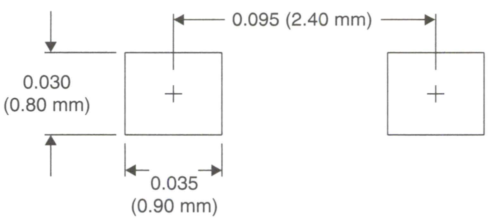
These drawings are for reference only. It is recommended that you consult with the company doing the component mounting and soldering to the printed circuit board. These companies have more information on options (various possible dimensions) of actual land patterns.



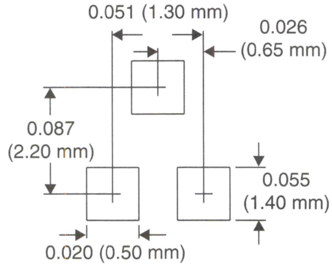
Chip Scale



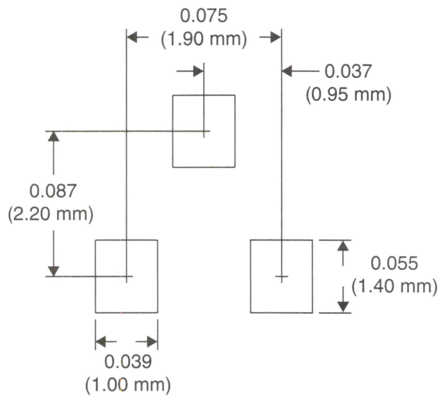
SC-79



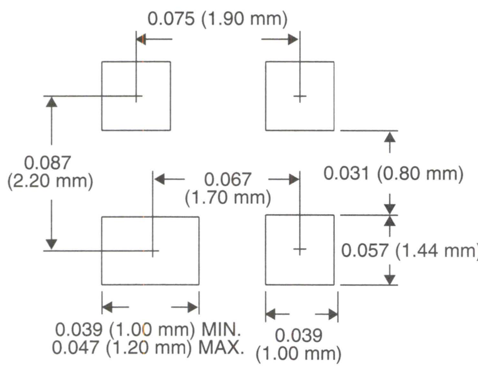
SOD-323



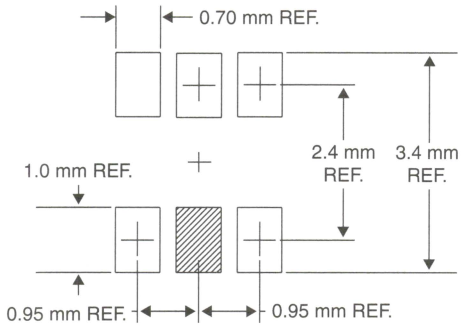
SC-70



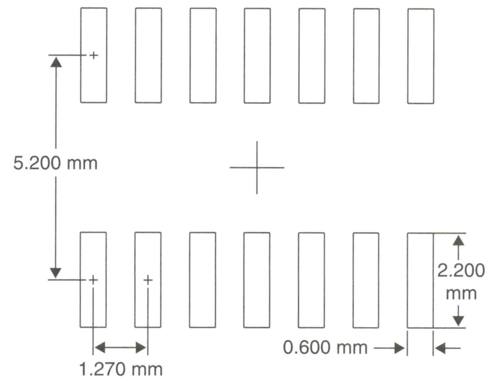
SOT-23 3 Lead



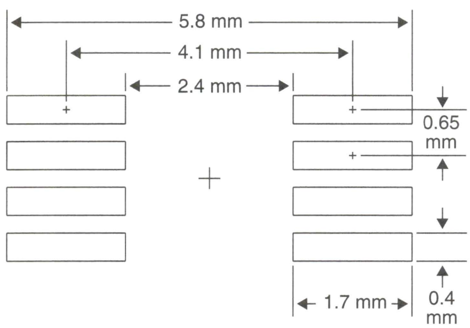
SOT-143



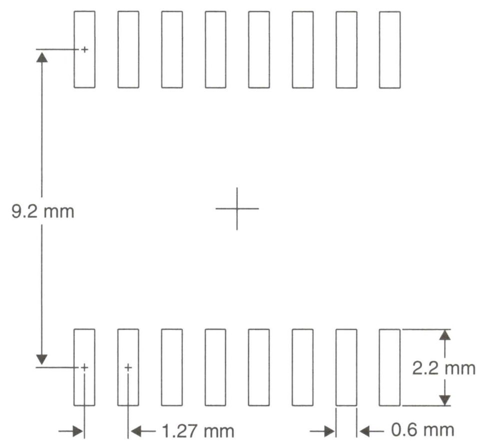
SOT-5, SOT-6



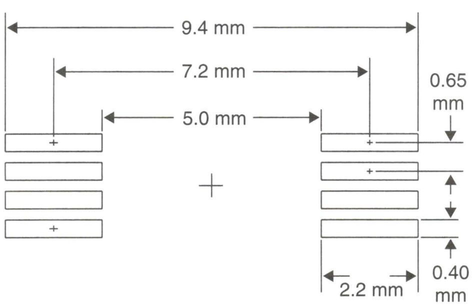
14 Lead SOIC Narrow Body



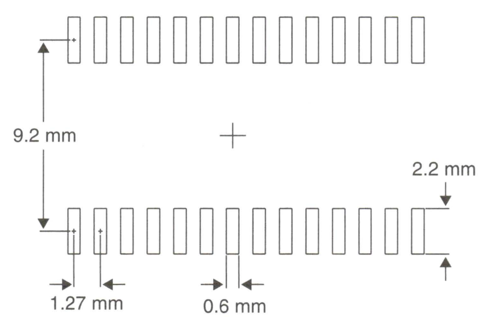
MSOP-8



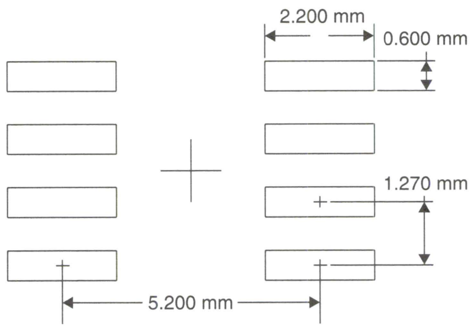
16 Lead SOIC Wide Body



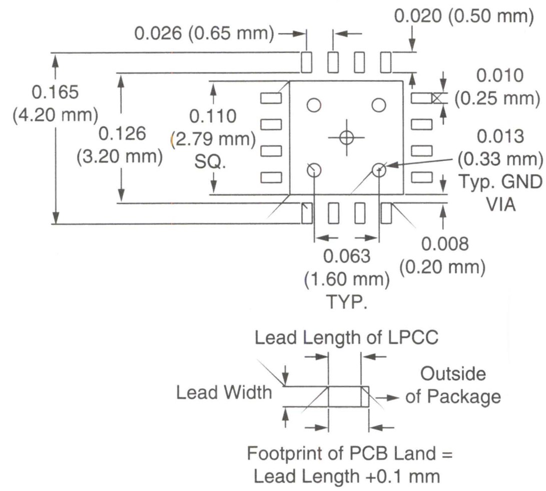
8 Lead SSOP (5.3 mm)



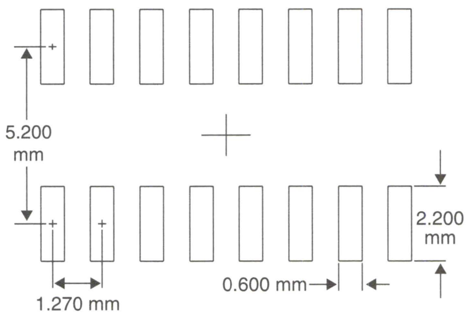
28 Lead SOIC Wide Body



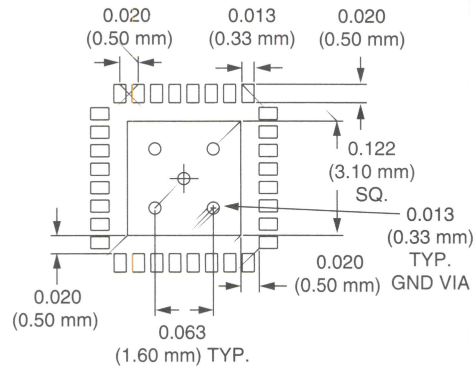
SOIC-8



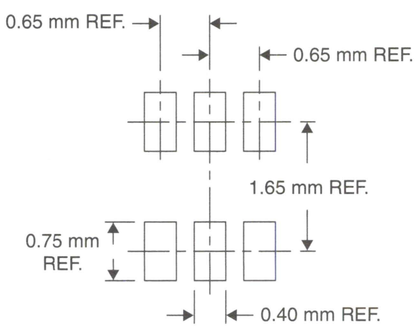
LPCC-16 Lead 4 x 4 mm (-307)
Surface Mount Land Pattern



16 Lead SOIC Narrow Body



QFN-32 Lead 5 x 5 mm (-310)
Surface Mount Land Pattern



SC-88 (6 Lead SC-70)

Detailed Surface Mount Guidelines for Leadless Packages

Skyworks' plastic encapsulated leadless style packages are being offered on several products to reduce size and weight and to improve application performance. These packages are gaining acceptance in the industry and are often referred to by such names as "QFN," "LPCC," "MLF" and others, and conform to JEDEC outline MO-220.

These packages use perimeter lands on the bottom of the package to provide contact to the PCB. These packages also have an exposed paddle on the bottom to provide a stable ground for optimum electrical performance of switches and attenuators, and an efficient heat path for thermal performance for amplifier products.

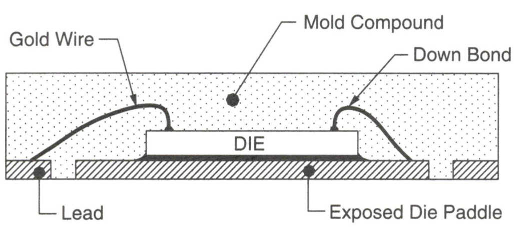


Figure 1. Package Cross Section

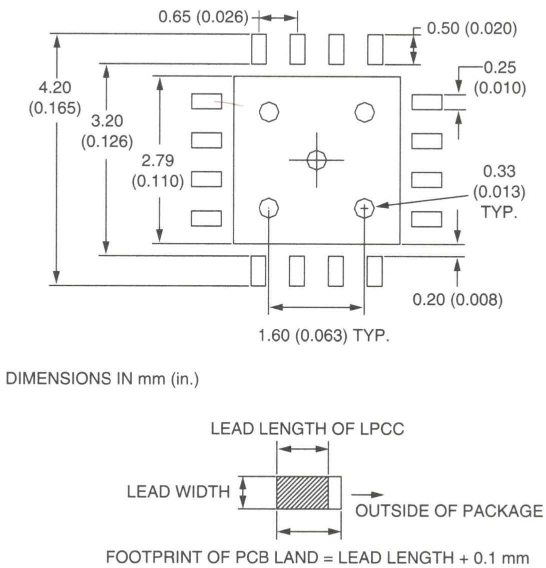


Figure 2. Surface Mount Land Pattern, 4 x 4 mm 16 Lead LPCC

Within are the suggested guidelines for layout of a PCB and stencil for Skyworks' 4 x 4 mm LPCC-16.

PCB Design Guidelines

For the lead/terminal solder pad design, it is recommended to use a Non Solder Mask Defined (NSMD) approach, but a small amount of solder mask should remain between the pads to avoid solder bridging between terminals. The PCB land width should match package pad width. The PCB land length should be 0.1 mm greater than the package pad length, with the extra area on the outside of the package. See Figure 2.

The ground pad on the PCB should match the size of the exposed paddle of the package and should be Solder Mask Defined (SMD). The solder mask opening should overlap the edges of the PCB ground pad by 0.065 mm (0.0025") on all four sides. The recommended design gap between the PCB ground pad and land pad is 0.15 mm minimum to avoid solder bridging and shorting. When space is available, a gap of 0.25 mm or more is preferred.

Plated thru via holes in the PCB ground pad should be 0.33 (0.013") in diameter and plugged. If via holes cannot be plugged, it is recommended to cap the vias on the backside of the board using solder mask material. This should allow the vias to be filled with solder during reflow.

Solder Mask Design

Two types of stencil designs are used for surface mount packages:

1. Solder Mask Defined (SMD): Solder mask openings smaller than metal pads.
2. Non-Solder Mask Defined (NSMD): Solder mask openings larger than metal pads.

NSMD is recommended for the perimeter I/O lands, as this allows the solder to wrap around the sides of the metal pads on the board for a reliable solder joint.

Because the spacing between the ground pad and the land pads can be small, SMD is recommended for the ground pad to prevent solder bridging.

A stainless steel stencil, 0.125–0.150 mm (0.005–0.006") thick, is recommended for solder paste application. For better paste release, the aperture walls should be trapezoidal and the corners rounded.

For the terminal lands, the stencil opening should be 0.05 mm larger than the PCB land (0.025 mm in each direction).

For the ground pad area, it is recommended to screen the solder paste in an array of small openings rather than one large opening. The total (cumulative) area of all the openings should be approximately equal to 50% of the total ground pad area. This will ensure good solder coverage with fewer voids. See Figure 3.

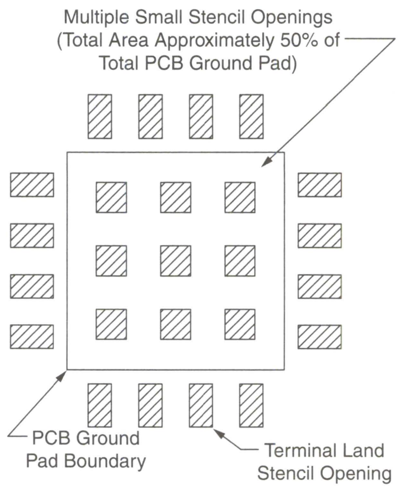


Figure 3. Recommended Stencil Design

Solder Paste and Reflow Profile

Because leadless packages have a low stand-off height and small terminal pitch, a No Clean, Type 3 solder paste, and a convection/IR reflow is recommended.

Sn63 (63% Sn, 37% Pb) solder is preferred because it is a eutectic compound with a melting point of 183°C. The reflow temperature in this case would be above 183°C for 30–60 seconds, with a peak temperature of 205–210°C.

If a lead-free alloy is used, such as tin/silver or tin/silver/copper, the melting point is 221°C and 217°C respectively. In this case, the profile would be above 221/217°C for 30–60 seconds, with a peak temperature of 230–240°C. Maximum temperature should not exceed 240°C.

A typical reflow profile is presented in Figure 4, which could be used as a starting point. The actual profile used will depend on the thermal mass of the entire populated board and the solder compound used.

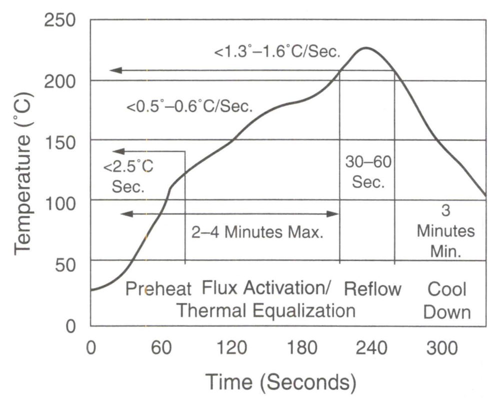


Figure 4. Typical Solder Reflow Profile

Solder Reflow Information

SKYWORKS

Assembly of a surface mount device depends on many process material and equipment parameters. Two of the most common processes used are infrared (IR) and IR-conversion. The lead finish of Skyworks surface mount devices is Sn/Pb (70%–90%/30%–10%) with a thickness ranging from 200–1000 micro-inches. This finish is compatible with all commonly used processes. The most common attachment process is the IR-conversion reflow process.

The reflow process requires applying solder and flux in the form of a paste to the areas of the substrate or PC board where the surface mount component connections are to be made. The solder and flux are applied to the circuit by screening, stenciling, or dot placement. This paste acts as a temporary adhesive holding the device in place until reflow soldering takes place. Optionally, a chip-bonding epoxy can be used to hold the device in place.

Solder paste manufacturers generally provide a recommended profile for the specific solder being used. This recommended profile, or the one depicted here, can be used as a starting point for profiling the process.

When using thermocouples for profiling, it should be noted that the outside edges and corners of an assembly heat up faster than the center, and components of greater thermal mass will heat more slowly than those of lesser thermal mass.

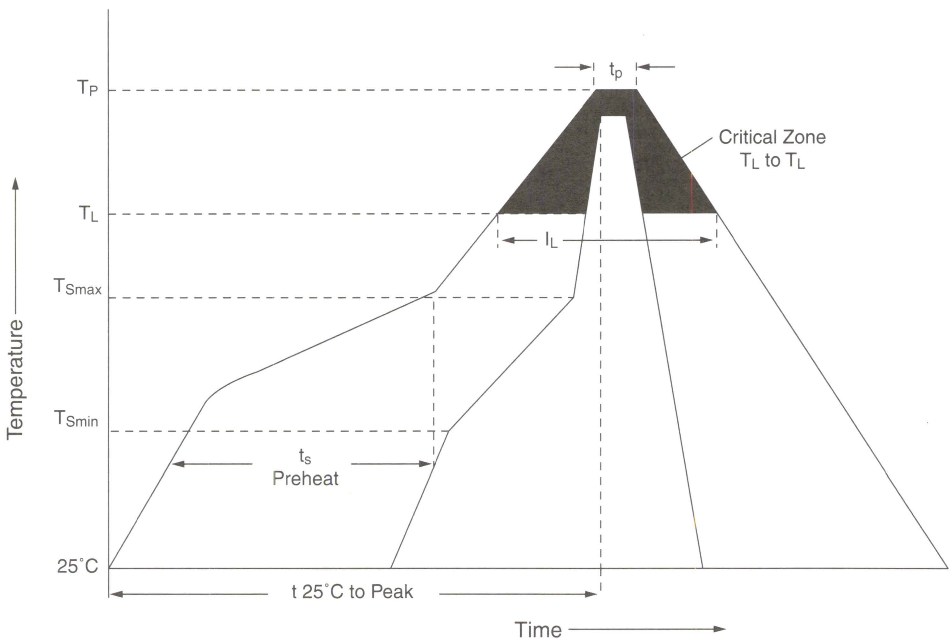
A thermal reflow process profile typically undergoes five transitions:

1. **Preheat** – Brings the assembly from 25°C to preheat zone and evaporates solvents from solder paste. A slow ramp up rate will prevent any damage due to thermal shock. The time and temperature to evaporate the solvents will depend upon the solder paste that is used.
2. **Flux Activation (Preheat–T_L)** – Dried solder paste is heated to a temperature in which the flux will react with the oxide and contaminants on the surfaces to be joined. The time and temperature should be long enough to allow the flux to fully clean these surfaces but not too long that the flux may be exhausted before soldering takes place.
3. **Thermal Equalization (Preheat–T_L)** – Achieves temperature equalization approximately 25–50°C below the reflow temperature. Time and temperature will depend upon the mass and materials.
4. **Reflow (T_L–T_P)** – In this stage the assembly is briefly brought to the temperature sufficient to produce reflow of solder. Maximum recommended reflow temperature is 235°C.
5. **Cool Down** – This is the final stage in the solder process. Gradual cooling should be used. The end result should be as fast as possible without causing thermal shock to the components. Cool down in this manner will produce a finer grain structure in the solder joint, which will yield a more fatigue resistant solder joint.

Recommended Solder Reflow Profiles

Profile Feature	SnPb Eutectic Assembly	Lead (Pb)-Free Assembly 100% Sn
Average Ramp-Up Rate (T_L to T_P)	3°C/Second Max.	3°C/Second Max.
Preheat Temperature Min. (T_{Smin}) Temperature Max. (T_{Smax}) Time (Min. to Max.) (ts)	 100°C 150°C 60–120 Seconds	 150°C 200°C 60–80 Seconds
T_{Smax} to T_L Ramp-up Rate	—	3°C/Second Max.
Time Maintained Above: Temperature (T_L) Time (t_L)	 183°C 60–150 Seconds	 217°C 60–150 Seconds
Peak Temperature (T_P)	240 +0/-5°C	250 +0/-5°C
Time Within 5°C of Actual Peak Temperature (tp)	10–30 Seconds	20–40 Seconds
Ramp-Down Rate	6°C/Second Max.	6°C/Second Max.
Time 25°C to Peak Temperature	6 Minutes Max.	8 Minutes Max.

All temperatures refer to the topside of the package, measured on the package body surface.
Reference JEDEC J-STD-020B.



Reference JEDEC J-STD-020

Varactor Markings

SKYWORKS

Markings	Part Number	Description
BE1	SMV1405-001	SOT-23 Single
BE3	SMV1405-074	SC-70 Common Cathode
Cathode	SMV1405-079	SC-79 Single
VV1	SMV1408-001	SOT-23 Single
AR1	SMV1413-001	SOT-23 Single
AV1	SMV1417-001	SOT-23 Single
AV3	SMV1417-004	SOT-23 Common Cathode
VY1	SMV1419-001	SOT-23 Single
Cathode	SMV1493-079	SC-79 Single
Cathode	SMV1494-079	SC-79 Single
AA1	SMV1211-001	SOT-23 Single
AB1	SMV1212-001	SOT-23 Single
AB3	SMV1212-004	SOT-23 Common Cathode
AB3	SMV1212-074	SC-70 Common Cathode
Cathode	SMV1212-079	SC-79 Single
n/a	SMV1213-001	SOT-23 Single
BD3	SMV1213-004	SOT-23 Common Cathode
BD3	SMV1213-074	SC-70 Common Cathode
Cathode	SMV1213-079	SC-79 Single
VL1	SMV1214-001	SOT-23 Single
VM1	SMV1215-001	SOT-23 Single
Cathode	SMV1215-011	SOD-323 Single
Cathode	SMV1129-011	SOD-323 Single
AX9	SMV1129-073	SC-70 Common Anode
Cathode	SMV1129-079	SC-79 Single
Cathode	SMV1139-011	SOD-323 Single
Cathode	SMV1139-079	SC-79 Single
AG3	SMV1135-004	SOT-23 Common Cathode
Cathode	SMV1135-011	SOD-323 Single
Cathode	SMV1245-011	SOD-323 Single
Cathode	SMV1265-011	SOD-323 Single
Cathode	SMV1281-011	SOD-323 Single
Cathode	SMV1283-011	SOD-323 Single
Cathode	SMV1142-011	SOD-323 Single

Markings	Part Number	Description
Cathode	SMV1143-011	SOD-323 Single
Cathode	SMV1144-011	SOD-323 Single
Cathode	SMV1145-011	SOD-323 Single
Cathode	SMV1145-079	SC-79 Single
Cathode	SMV1146-011	SOD-323 Single
Cathode	SMV1147-011	SOD-323 Single
Cathode	SMV1148-011	SOD-323 Single
Cathode	SMV1232-011	SOD-323 Single
CC3	SMV1232-074	SC-70 Common Cathode
Cathode	SMV1232-079	SC-79 Single
VP1	SMV1233-001	SOT-23 Single
VP9	SMV1233-003	SOT-23 Common Anode
VP3	SMV1233-004	SOT-23 Common Cathode
Cathode	SMV1233-011	SOD-323 Single
VP9	SMV1233-073	SC-70 Common Anode
VP3	SMV1233-074	SC-70 Common Cathode
Cathode	SMV1233-079	SC-79 Single
VQ1	SMV1234-001	SOT-23 Single
VQ9	SMV1234-003	SOT-23 Common Anode
VQ3	SMV1234-004	SOT-23 Common Cathode
Cathode	SMV1234-011	SOD-323 Single
VQ9	SMV1234-073	SC-70 Common Anode
VQ3	SMV1234-074	SC-70 Common Cathode
Cathode	SMV1234-079	SC-79 Single
VR1	SMV1235-001	SOT-23 Single
VR3	SMV1235-004	SOT-23 Common Cathode
Cathode	SMV1235-011	SC-70 Single
VR3	SMV1235-074	SC-70 Common Cathode
Cathode	SMV1235-079	SC-79 Single
AQ1	SMV1236-001	SOT-23 Single
AQ3	SMV1236-004	SOT-23 Common Cathode
Cathode	SMV1236-011	SOD-323 Single
AQ3	SMV1236-074	SC-70 Common Cathode
Cathode	SMV1236-079	SC-79 Single

All SOD-323 (-011) and SC-79 (-079) packages have a cathode mark only.

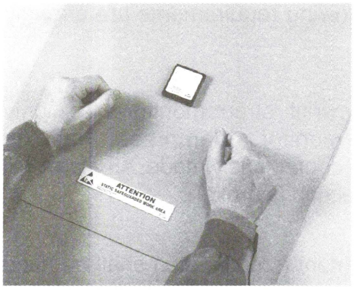
Markings	Part Number	Description
VT1	SMV1237-001	SOT-23 Single
VT3	SMV1237-004	SOT-23 Common Cathode
VT3	SMV1237-074	Common Cathode SC-70
BF3	SMV1247-074	SC-70 Common Cathode
Cathode	SMV1247-079	SC-79 Single
BG1	SMV1248-001	SOT-23 Single
F1	SMV1249-001	SOT-23 Single
AF9	SMV1249-003	SOT-23 Common Anode
Cathode	SMV1249-011	SOD-323 Single
AF9	SMV1249-073	SC-70 Common Anode
Cathode	SMV1249-079	SC-79 Single
AH1	SMV1251-001	SOT-23 Single
AH3	SMV1251-004	SOT-23 Common Cathode
Cathode	SMV1251-011	SOD-323 Single
AH3	SMV1251-074	SC-70 Common Cathode
Cathode	SMV1251-079	SC-79 Single
AJ3	SMV1253-004	SOT-23 Common Cathode
Cathode	SMV1253-079	SC-79 Single

Markings	Part Number	Description
AK1	SMV1255-001	SOT-23 Single
AK3	SMV1255-004	SOT-23 Common Cathode
Cathode	SMV1255-011	SOD-323 Single
AK9	SMV1255-073	SC-70 Common Anode
Cathode	SMV1255-079	SC-79 Single
Cathode	SMV1263-079	SC-79 Single
AE3	SMV1269-074	SC-70 Common Cathode
Cathode	SMV1270-079	SC-79 Single
AT3	SMV1470-004	Common Cathode SOT-23
Cathode	SMV1705-079	SC-79 Single
Cathode	SMV1763-079	SC-79 Single
Cathode	SMV1770-079	SC-79 Single
Cathode	SMV1771-079	SC-79 Single
VJ1	SMV2022-001	SOT-23 Single
VJ3	SMV2022-004	SOT-23 Common Cathode
VK1	SMV2023-001	SOT-23 Single
VK3	SMV2023-004	SOT-23 Common Cathode

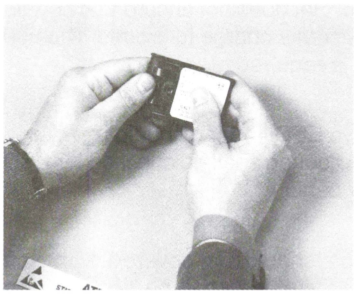
All SOD-323 (-011) and SC-79 (-079) packages have a cathode mark only.

Waffle Pack Chip Carrier Handling/Opening Procedure

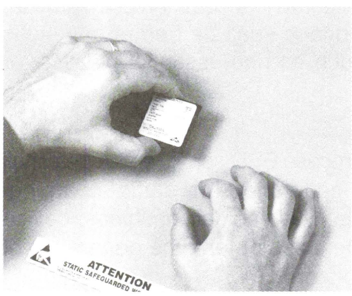
SKYWORKS



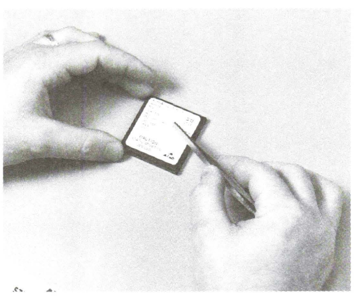
Proper ESD handling practice should be adhered to at all times when handling Skyworks product.



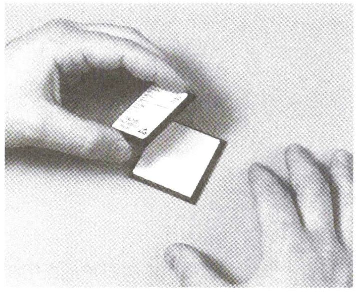
Step 1
Remove carrier clip. Do not allow separation between the waffle pack and cover.



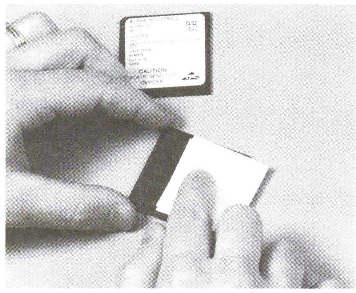
Step 2
Place lidded waffle pack onto a flat ESD surface. Avoid separation between the waffle pack and cover.



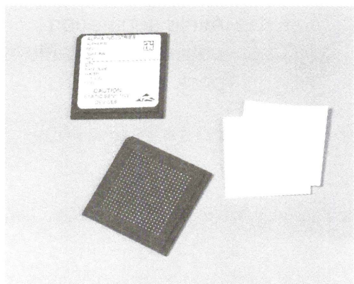
Step 3
Gently tap cover using the handle of a set of tweezers. This will remove any devices that are clinging to the inside paper.



Step 4
Lift cover.



Step 5
Remove the two layers of paper. They should be slid off the waffle pack with light pressure.



Step 6
Remove die from carrier. The use of a vacuum tool is strongly suggested. Tweezers should not be used to remove die.

ESD Awareness

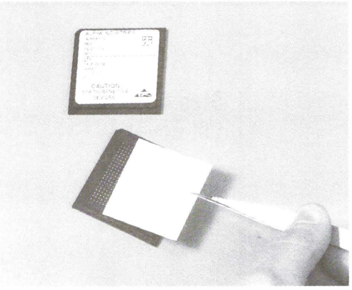
Skyworks deploys state of the art ESD controls from wafer fabrication through to assembly, test and pack. In order to maintain device integrity, Skyworks has outlined critical ESD guidelines that should be followed as a minimum. Skyworks adheres to the requirements outlined in MIL-HDBK-263, MIL-STD-1686 and ESD Association 2.0 Handbook.

Caution

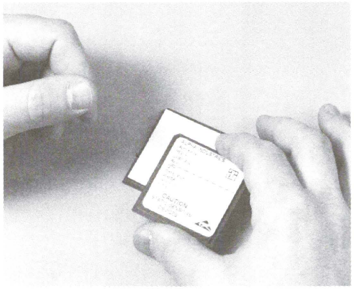
Devices should only be handled at an ESD approved workstation.

Waffle pack chip carriers are made of ChipSentry® black conductive polycarbonate from fluoroware.

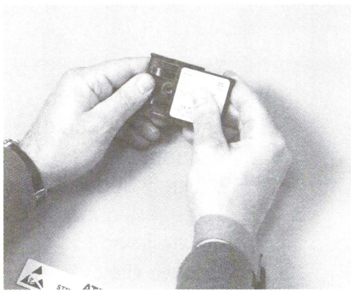
Closing



Step 1
When closing the package the two layers of paper should be aligned properly with the waffle pack.



Step 2
The cut corner in the upper left should match up on the waffle pack and cover. The clip can be put back on when the cover is properly set on waffle pack.



Step 3
Slide carrier clip on. Avoid separation between the waffle pack and cover.

Device Handling

Remove ESD sensitive devices from protective containers at approved ESD work stations only.

ESD wrist straps are required when handling devices outside their ESD protective packaging.

All personnel shall be properly grounded (footstraps/wrist straps) prior to opening static shielding bags.

ESD sensitive devices should always be handled by the part body. Avoid touching the leads. When hand tools are required to accomplish an operation, use only dissipative, conductive, or tools treated with topical antistat.

ESD Workstation

Your ESD safe work area should follow the requirements outlined in MIL-HDBK-263 and ESD Association Handbook 2.0. The following requirements are strongly recommended:

Personnel
The use of constant wrist strap monitors is highly recommended. This monitor guarantees that the connection to ground is continuously made. An alarm will sound when that connection is broken.

Clothing
An ESD protective garment (smock, etc.) shall be used at the workstation. While a person may be grounded using a wrist strap or foot strap, that does not ensure that certain clothing fabrics can dissipate a charge to ground. The use of a conductive smock is required.

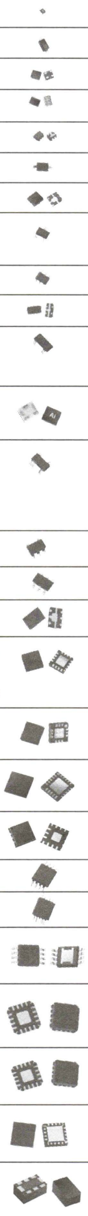
Floors
Conductive or dissipative ESD flooring should be utilized whenever possible. This flooring shall be checked for ESD properties on a regular basis.

Work Surfaces
Your ESD work surface should be covered with soft dissipative material. This surface shall be tied to earth ground and shall be configured in a common point ground. In addition, the work surface shall be free of any static generating material, such as non-essential plastics, or scotch tape.

Equipment
All equipment used to process ESD sensitive devices shall be checked for the generation of static charging. Whether soldering irons, wave solder machines, device insertion machines or test equipment, the generation of static electricity is of concern.

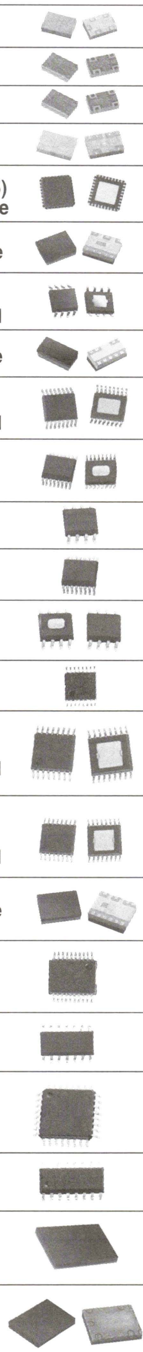
Semiconductor Plastic Package Selection Guide

SKYWORKS



PART NUMBER REFERENCE	PACKAGE TYPE	ACTUAL SIZE	PACKAGE DIMENSIONS (mm) (LEAD INCLUSIVE)*
-050	Chip Scale		0.68 x 0.56 x 0.3
-079	SC-79		1.6 x 0.8 x 0.6
-508	LGA		1.44 x 1.20 x 0.70
-334	LGA-6		1.5 x 1.2 x 0.82
-344	SOT-666		1.65 x 1.65 x 0.6
-011	SOD-323		2.52 x 1.25 x 1.04
-335	QFN-6 (2 x 2)		2.0 X 2.0 X 0.90
-073, -074, -075, -076	SC-70		2.1 x 2.0 x 0.95
-92	SC-88		2.1 x 2.0 x 0.95
-322	QFN-5		2.0 x 1.0 x 0.4
-001, -003, -004 -005, -006, -007, -39	SOT-23		2.37 x 2.92 x 1.0
-111	Surface Mount Package		2.79 x 2.28 x 1.01
-015, -016, -017, -019, -020, -021, -022, -023, -026, -32	SOT-143		2.37 x 2.92 x 1.0
-027, -72	SOT-23 5L		2.8 x 2.9 x 1.18
-73	SOT-23 6L		2.8 x 2.9 x 1.18
-313	QFN-6		2.0 x 3.0 x 1.0
-320	Thermally Enhanced Ultra-Small Micro Lead Frame Package		3.0 x 3.0 x 0.75
-321	QFN-12 (3 x 3) 1.45 mm Paddle		3.0 x 3.0 x 0.75
-340	QFN-20 (4 x 4) 2.1 mm Paddle		4.0 x 4.0 x 0.75
-317	QFN-16 (4 x 4) 1.47 mm Paddle		4.0 x 4.0 x 1.0
-59	MSOP-8		4.9 x 3.0 x 0.96
-86	MSOP-10		4.9 x 3.0 x 0.96
-302	MSOP-8 Exposed Pad		4.9 x 3.0 x 1.1
-300	QFN-16 (4 x 4) 1.7 mm Paddle		4.0 x 4.0 x 0.9
-306	QFN-16 (4 x 4) 2.1 mm Paddle		4.0 x 4.0 x 0.9
-307	QFN-16 (4 x 4) 2.8 mm Paddle		4.0 x 4.0 x 0.9
-315	LGA Surface Mount Package		4.9 x 3.2 x 2.32

* Dimensions indicated: lead tip to lead tip x body width x total thickness.
Visit our web site for the latest information at www.skyworksinc.com



PART NUMBER REFERENCE	PACKAGE TYPE	ACTUAL SIZE	PACKAGE DIMENSIONS (mm) (LEAD INCLUSIVE)*
-614	LTCC		5.0 x 3.2 x 1.2
-605	LTCC		5.0 x 3.2 x 1.4
-610	LTCC		5.0 x 3.2 x 1.4
-608	LTCC		5.0 x 3.25 x 1.2
-310	QFN-32 (5 x 5) 3.3 mm Paddle		5.0 x 5.0 x 0.9
-602	LTCC Module		5.4 x 4.0 x 1.7
-339	SOIC-8 Exposed Pad		5.99 x 4.93 x 1.55
-606	LTCC Module		6.0 x 3.0 x 1.7
-89	SSOP-16 Exposed Pad		6.0 x 4.9 x 1.6
-79	SSOP-16 With Slug		6.0 x 4.9 x 1.45
-12	SOIC-8		6.0 x 4.9 x 1.6
-80	SSOP-16		6.0 x 4.9 x 1.6
-84	SOIC-8 With Slug		6.0 x 4.9 x 1.45
-87	TSSOP-16		6.4 x 5.0 x 1.0
-93	TSSOP-16 Exposed Pad		6.4 x 6.4 x 1.0
-94	TSSOP-20 Exposed Pad		6.4 x 6.5 x .98
-603	LTCC Module		6.7 x 5.0 x 1.7
-85	SSOP-20		7.8 x 7.2 x 1.9
-24	SOIC-14		6.0 x 8.7 x 1.55
-61	LQFP-32 (7 x 7)		9.0 x 9.0 x 1.5
-25	SOIC-16		10.0 x 6.0 x 1.7
-500	LGA-16		11.6 x 4.1 x 1.5
-501	LGA-16		10 x 8 x 1.4

Package Style/Part Number Reference

SKYWORKS

Package Style	Packaging Part Number Suffix
Chip	-000, -00
SOT-23	-001
SOT-23	-003
SOT-23	-004
SOT-23	-005
SOT-23	-006
SOT-23	-007
SOD-323	-011
SOT-143	-015
SOT-143	-016
SOT-143	-017
SOT-143	-019
SOT-143	-020
SOT-143	-021
SOT-143	-022
SOT-143	-023
SOT-143	-026
SOT-5 Lead	-027
Chip Scale	-050
SC-70	-073
SC-70	-074
SC-70	-075
SC-70	-076
SC-79	-079
Wafer	-099
SOIC-8	-12
SOIC-14	-24
SOIC-16	-25
SOT-143	-32
SOT-23	-39
MSOP-8	-59
LQFP-32 (7 x 7 mm)	-61
SOT-5	-72
SOT-6	-73
PFP-16 with Slug (7 x 7 mm)	-75
SSOP-16 with Slug	-79
SSOP-16	-80
SOIC-8 with Slug	-84
SSOP-20	-85
MSOP-10	-86

Package Style	Packaging Part Number Suffix
TSSOP-16	-87
SSOP-16 Exposed Pad	-89
SC-88 (6 Lead SC-70)	-92
TSSOP-16 Exposed Pad	-93
TSSOP-20 Exposed Pad	-94
Chip on Board	-100
Chip on Board	-101
Chip on Board	-102
Chip on Board	-103
Surface Mount Package	-111
QFN-16 (4 x 4 mm) 1.7 mm Paddle	-300
MSOP-8 Exposed Pad	-302
QFN-16 (4 x 4 mm) 2.1 mm Paddle	-306
LPCC-16 (4 x 4 mm) 2.8 mm Paddle	-307
QFN-32 (5 x 5 mm) 3.3 mm Paddle	-310
QFN-12 (3 x 3 mm)	-311
QFN-6	-313
LGA	-315
QFN-16 (4 x 4 mm) 1.47 mm Paddle	-317
Thermally Enhanced Ultra Small Micro Lead Frame Package	-320
QFN-12 (3 x 3 mm)	-321
QFN-5	-322
LGA-6	-334
QFN-6 (2 x 2 mm)	-335
QFN-16 (4 x 4 mm) 2.1 mm Paddle	-338
SOIC-8 Exposed Pad	-339
QFN-20 (4 x 4 mm)	-340
SOT-666	-344
LGA-16 (11.6 x 4.1 x 1.5 mm)	-500
LGA-16 (10.0 x 8.0 x 1.4 mm)	-501
LGA	-508
LTCC Module	-602
LTCC Module	-603
LTCC	-605
LTCC	-606
LTCC	-608
LTCC	-610
LTCC	-613
LTCC	-614

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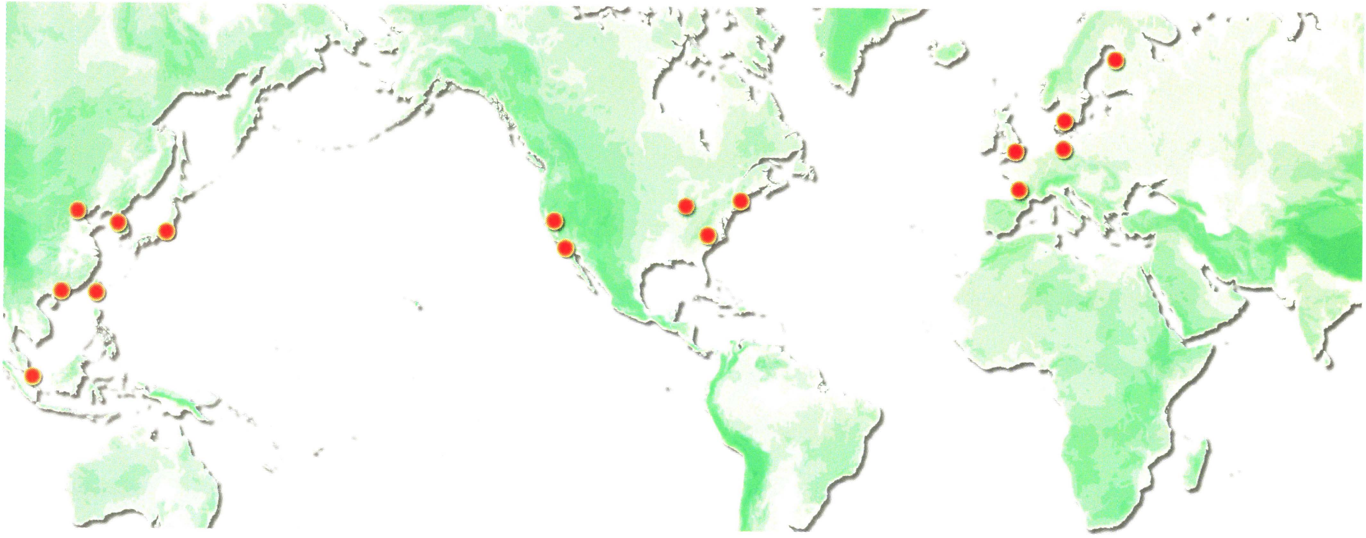

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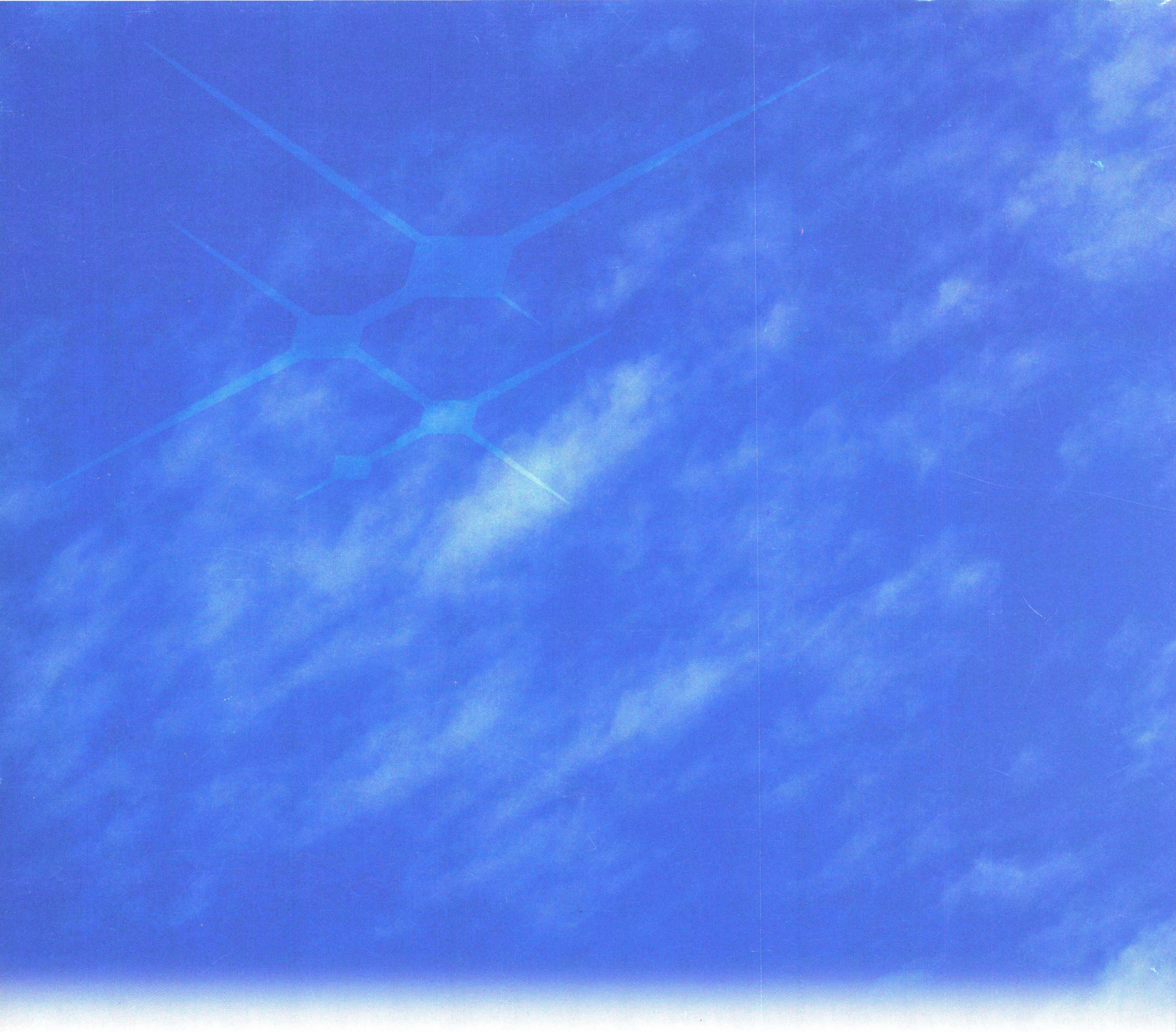

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